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The focus of the International Journal of Teaching and Learning in Higher Education is broad and includes all aspects of higher education pedagogy, but it focuses specifically on improving higher education pedagogy across all content areas, educational institutions, and levels of instructional expertise. Manuscripts submitted should be based on a sound theoretical foundation and appeal to a wide higher education audience. Manuscripts of a theoretical, practical, or empirical nature are welcome and manuscripts that address innovative pedagogy are especially encouraged.

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Review Process

Following a brief editorial review, each manuscript will be blind reviewed by two members of the Review Board. The review process will take approximately 90 days. At the end of the 90-day review process authors will be notified as to the status of their manuscripts - accept, revise and resubmit, or reject - and will receive substantive feedback from the reviewers. Manuscript authors are responsible for obtaining copyright permissions for any copyrighted materials included within manuscripts.

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The Power of Peer Reviewing to Enhance Writing in Horticulture: Greenhouse Management

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Peer review is not included in undergraduate horticultural curricula. Our research objectives in an 8-year study, which ranged from 2000 to 2007 in two sections (2000-2002 non-peer reviewed and 2003-2007 peer-reviewed) of Greenhouse Management students at the University of Minnesota were to determine whether iterative peer reviews would result in improved learning, enhanced writing, refined revision processes, and higher written paper/course grades for undergraduate and professional horticulture students, as well as the effects of double blinding, whether years affected any parameter and the validity/reliability of peer reviews. Both sections were assigned a semester-long, 3-phase writing-intensive assignment. Principle findings that emerged were: (a) after engaging in iterative structured peer-reviews, student final grades in the peer review group exceeded those in 2/3 of non-peer reviewed years; (b) students quickly identified superior papers; (c) while students grasped the peer review process and matched their editing skills with the instructor and teaching assistants by Phase II, a lag time (Phase III) occurred before it significantly increased their grades; (d) graded paper scores were not different across years; (e) anonymity of peer reviews had no effect; and (f) students were initially able to recognize writing issues in peers' drafts and address them in their own writing. Inclusion of more than 2 peer reviews into horticulture courses is highly recommended.

Recent studies sponsored by the National Research Council (NRC, 1997, 1999, 2003) have referenced a growing body of empirical research that suggest student learning can be enhanced when college instructors in all disciplines incorporate teaching strategies that promote student-centered, interactive activity and work toward clearly measurable learning outcomes (McCray, DeHaan, & Schuck, 2003). The idea that what students learn is affected by how they learn is particularly pertinent in undergraduate science, technology, engineering, and mathematics (STEM) curricula, where lecture and lab course formats remain all but intractable (American Association for the Advancement of Science, 1990; Boyer Commission on Educating Undergraduates in the Research University, 1998; NRC, 1997, 1999). Specific recommendations include providing students in STEM disciplines more frequent opportunities to work in small interactive groups. A recent study presented at the annual meeting of the American Council on Higher Education found that forms of small-group learning resulted in increased academic achievement and retention of students in STEM programs (Springer, Donovan, & Stanne, 1999).

A desire to develop undergraduate students of horticulture into lifelong learners and professional writers—both during their degree programs and as graduates in their professions—has prompted many educators to incorporate active learning strategies into their coursework (MacKay, Emerson, MacKay, Funnell, & Welsh, 1999). For decades, faculty members in our department have relied on decision case studies as a method for engaging undergraduate horticulture students as hands-on stakeholders and critics of real or hypothetical situations (Davis 1992a, 1992b). However,

as the University of Minnesota, a large-enrollment public research university, became increasingly invested in writing initiatives, the Department of Horticultural Science followed suit by successfully integrating both high- and low-stakes writing activities in lower- and upper-division courses (Anderson, 2001a, 2001b; 2002; Anderson & Walker, 2003; Foulk & Hoover, 1997; Hoover, 1993; Kuehny & McMahon, 1998; Meyer & Allen, 1994).

Shifts from curricula emphasizing content delivery (i.e., lecture-lab course format) to curricula that integrate iterative writing activity is evidenced by national and, increasingly, international writing initiatives. Throughout the 1980s and into the 1990s many post-secondary institutions across the country created Writing Across the Curriculum (WAC) programs and implemented writing-intensive (WI) course requirements to ensure that writing would be taught in all undergraduate majors (Bridwell-Bowles, 1993; Firman, 1992; Russell, 2002). A national survey of colleges and universities conducted between 2006 and 2008 identified more than 500 WAC programs. Of these, 330 have instituted WI course requirements (Thaiss & Porter, 2010). Our own university implemented an ambitious four-course WI requirement in 1999 and has, since 2007, piloted an innovative curricular approach to writing called the Writing-Enriched Curriculum Project (WEC). WEC supports departments and colleges—including Horticultural Science—in the intentional integration of developmentally sequenced writing instruction throughout all undergraduate curricula. As a result of these and other initiatives, scientific writing and writing instruction has become more widely accepted in the

horticulture curriculum by faculty and students alike (Zambreno, Hoover, Anderson, & Gillman, 2004).

Peer Review

Although scholarly applications of peer reviewing have been in place since the 1600s (Kronick, 1990), it did not become an accepted and mandatory scientific practice until post-World War II (Burnham, 1990) when scientific knowledge became common property (Carlsen, Cunningham, & Trautmann, 2001). Over the past few decades, much of the attention devoted to peer review has been focused on refining the procedure itself. More studies have, for example, been conducted into the effects of anonymity using blind editorial reviews (McNutt, Evans, Fletcher, & Fletcher, 1990) than into its efficacy as a learning tool in the undergraduate science classroom. While structured peer response activity has served as a successful and almost requisite component of written composition and creative writing courses at both secondary and post-secondary educational levels since the 1970s when Peter Elbow wrote his influential monograph *Writing Without Teachers* (Elbow, 1973; Gere, 1987; Lindemann, 1995), the first science educators to provide instructional guidelines for classroom peer review were Gratz (1990), Pechenik and Tashiro (1991), and Mangelsdorf (1992). Peer reviews in the classroom consist of a revision phase or phases based on their peer's/instructor's edits (Cho & MacArthur, 2010) and differ from peer assessments, wherein the latter assesses performance for a group task (Loddington, Wilkinson, Bates, Crawford, & Willmot, 2008). Billington (1997) proposed that peer reviewing can provide a motivational impetus for enhancing scientific writing—both for the reviewer and the authors whose papers are being reviewed—although the quality of the reviews can vary significantly between students (Bos, Krajcik, & Soloway, 1997; Moreira & Silva, 2003).

Theoretical Components of Classroom Peer Reviewing

The use of peer reviewing in the classroom has several purposes, namely to increase students' domain-specific knowledge levels (Papadopoulos, Lagkas, & Demetriadis, 2012), engage students in active learning that increases their reviewer skills (McConnell, 2001), foster higher-level learning/skill-building (Anderson & Krathwohl, 2001) by incorporating and emphasizing concepts and improve writing through reflecting and revising (Papadopoulos et al., 2012). Likewise, peer review reiterates and enforces the instructor's or teaching assistant's (TA) editing and comments with meaning and understanding, often complimentarily

reducing the lengthy instructor/TA editing time (Yang, 2011).

Common research designs for peer review testing in classroom learning involve: (a) two students who exclusively review each other's work (assigned-pair, dyad, or reciprocal; Cho & Schunn, 2007; Papadopoulos et al., 2012; Yang, 2011), (b) multiple reviewers for each student (more than 2; Reily, Finnerty, & Terveen, 2009; Tsai & Liang, 2009; Tseng & Tsai, 2007), or (c) variable (i.e., free-selection protocol) where students select the writing to be reviewed (Papadopoulos et al., 2012). These designs may influence the written product and peer review effects, particularly if students do not work well together in a dyad, too many reviewers dilute the feedback and its impact or shorter, less difficult papers are chosen.

The key components of peer reviewing have been summarized by Papadopoulos et al. (2012) into four phases: (1) producing initial student work, (2) assigning reviewers, (3) review/feedback production, and (4) revisions. These phases are categorically subdivided into a description, expected benefits, key research questions and research evidence. While many courses across multiple domains and disciplines have used peer reviewing in higher education, fewer pedagogical studies have tested mechanisms, function, reliability, and validity of peer reviews (Reynolds & Thompson, 2011; Topping, 1998). Of those courses that have used peer reviewing, students had demonstrably enhanced learner outcomes and increased reviewer skills (Papadopoulos et al., 2012), particularly in their ability to identify substandard writing (Yankulov & Couto, 2012). Many important research questions remain regarding the effectiveness of peer reviewing in the classroom (Yankulov & Couto, 2012).

Peer Reviewer-Based Learning in Horticultural Science

Peer reviewing in horticulture is commonly conducted outside of classroom learning. It is restricted primarily to: (a) manuscripts submitted for publication as primary literature in peer-reviewed journals, serials, or monographs; (b) competitive grant proposals; (c) faculty promotion and tenure documents; (d) intellectual property applications; and less rarely for (e) trade journal articles or those destined for the popular press (Pollock, 1990; Ware, 2009). Such reviews may be quantitative (competitive grant proposals) or qualitative in nature (Ware, 2009). Further, their effectiveness has been scrutinized (Pollock, 1990). Undergraduates would rarely be exposed to peer reviewing while graduate students may encounter it in limited graduate courses with grant-writing assignments. Otherwise, graduate students and those

who become academic faculty are submitted to *de rigueur* of peer reviewing with formal training by their graduate advisor(s). Thus, using peer review as an educational tool for horticulture students to enhance their writing and gain feedback from peers is an unprecedented educational opportunity for the discipline of horticultural science.

A Key Peer Review Research Issue

While instructors in almost every discipline or domain have developed tools to enhance undergraduate/graduate student critical thinking skills and writing (Papadopoulos et al., 2012), most scientific studies testing their implementation and effectiveness are short-term, often for a single semester, quarter, or academic year (Anderson & Walker, 2003; Bos et al., 1997; Foulk & Hoover, 1997; Kuehny & McMahon, 1998; Likkel, 2012; Yang, 2011). Two exceptions involve 5-year peer review studies in computer networking (Papadopoulos, Lagkas & Demetriadis, 2012) and molecular genetics (Yankulov & Couto, 2012) courses. However, in both studies analyses of yearly variation in either the reviewers' or student performance were not performed. Thus, the issue of year-to-year variation in peer reviewing is unknown.

Purpose of the Current Study

A general lack of long-term educational pedagogical studies in higher education, as well as complete omission of peer review in curricula such as horticultural science, led to the formulation of this long-term study. The objectives of our 8-year study were to determine whether including iterative peer reviews in a semester-long writing intensive upper-division required horticulture course would result in improved learning, enhanced writing, refined revision processes, and higher written paper/course grades for undergraduate and professional horticulture students. Additional objectives of interest were the effects of double blinding, whether years affected any parameter, and the validity and reliability of peer reviews at the undergraduate level (Carlsen et al., 2001). These research objectives correspond to Phases 2 to 4 of the peer review process identified by Papadopoulos et al. (2012), as outlined above.

Methodology

Course Context

This research was conducted during eight spring semesters (2000-2007) with 257 primarily undergraduate students (Environmental Horticulture or other majors) enrolled in the Greenhouse Management

class (Hort 3002W). Participants were predominantly undergraduates or professional (non-dissertation Master of Agriculture) students from the Department of Horticultural Science (~95%); the remainder (~5%) were landscape architecture and landscape design students. The prerequisite for this course was Plant Propagation, a science with laboratory course that teaches horticultural fundamentals. Hort 3002W was designed to enhance students' understanding of crop production in controlled environments. This course focused on building a technical knowledge base and providing opportunities for students to apply this foundational knowledge to practical situations (Nelson, 2003).

Target Assignment

Since 2000, the course expanded its writing component to reach well beyond the typical laboratory report. The course's primary assignment, a written project called the Greenhouse Design Project (GDP), required students to parlay classroom/laboratory education into a formal writing venue. For the GDP, students designed a greenhouse and described the proposed greenhouse operation as part of a hypothetical bank loan application to the fictional Floratech National Bank. This assignment was written in three phases (GDP I, GDP II, and GDP III) and resulted in a 15- to 35-page document that constituted 65% of the students' course grades.

The GDPs three phase components consisted of the following information. For the GDP I (4 weeks to write and submit this phase), students selected horticultural crop(s) to produce, product markets (e.g., mass market/wholesale, retail outlets, florists, grocery stores), and type of 50,000 ft^2 greenhouse facility (propagator or rooting station; pre-finisher or finisher grower). The GDP II (5 weeks to write and submit) included revision of GDP I with a memorandum that highlighted responses to peer reviewer or instructor/TA edits, plus a finalized construction budget estimate, the complete layout of the facility, and all heating/cooling calculations. For the GDP III (6 weeks to write and submit), students revised their GDP II and included a memorandum highlighting responses to instructor/TA or peer reviewer edits, a detailed schematic of the first year's production schedule to ensure economic feasibility and a mean of more than 100% space use efficiency, and an average turn-over rate of 10%/week for all crops. Students enhanced their loan applications with introductory letters to bank loan officers with descriptions of their business and marketing plans, as well as other innovative selling points.

At its inception in 2000, the GDP was designed as a tool for modeling and enhancing writing by undergraduates within the horticultural curriculum and

as a means for elevating and reinforcing students' experiential learning (Huang, 2002), active-collaborative participation in course activity (Orr, 1996), and development of such higher cognitive skills as application, analysis, synthesis, and evaluation (Bloom, 1956). The assignment was also designed to integrate course content within an associated framework of practical and integrative learning for student advancement in their careers (MacKay et al., 1999).

Participants

To determine whether student writing would benefit more from instructor/teaching assistant assessment at each GDP phase or if the incorporation of peer reviews would enhance student writing and learning processes, we studied groups of students who completed the assignment with and without engaging in reciprocal peer reviews. From 2000 to 2007, 257 students participated in this writing assignment in non-peer reviewed (NPR; from 2000-2002) or peer-reviewed (PR; from 2003-2007) groups. Since the course only had one section per year, NPR vs. PR groups could not be assessed concurrently each year as students would have had ample opportunity to share peer review information between groups; this would have reduced or eliminated testing the effectiveness of the peer review treatment.

From 2000 to 2002, students completed the GDP Phases I through III but did not engage in peer reviews. These NPR years' data constitute the control group for this experiment. In contrast, from 2003 to 2007, students completed the same assignment with the addition of two peer review sessions conducted within lecture periods. While less than an ideal setup for the control group, we could not institute a control group each year as the course had only one section with 26-38 students. As the students were in a cohort and predominantly in the same major, it was not possible to prevent information flow between the NPR and PR groups. We found at least one previous peer review study did not have a control group (Yankulov & Couto, 2012). The number of participating, enrolled students in this experiment was: 30 students in 2000, 35 students in 2001, 33 students in 2002, 35 students in 2003, 26 students in 2004, 31 students in 2005, 38 students in 2006, and 29 students in 2007. Thus, there were 98 students participating in the 3-year NPR control group (2000-2002) and 159 in the 5-year PR group (2003-2007).

Peer Review Design

During the 2003 to 2007 academic years, GDP Phases I and II work done by students in the peer review treatment group underwent review by two student colleagues in each assigned laboratory group of three to five students. Thus, this study uses the multiple reviewer method (Tsai & Liang, 2009; Tseng & Tsai, 2007). The peer review design, format and approach for use in this course were created in consultation with our institution's writing center (Flash, 2002). Implementation details are important for student satisfaction and outcomes (Likkel, 2012; Walvoord, Hoefnagels, Gaffin, Chemchal, & Long, 2008). The peer review forms were designed to scaffold—or sequence incrementally—constructive criticism and minimize risky classmate alienation due to negative feedback (Bos et al., 1997; Cho & Schunn, 2007). As effective peer review prompts start with identification of tasks and then move to tasks involving analytic, diagnostic, and evaluative responses (Flash, 2002) and, in both cases, require that students write directly on the GDP drafts, we designed peer review activities that were completed by students both in and out of class (Appendices A and B) and designed a sequence of appropriate modeling procedures. Useful peer review critiques were modeled in an explanatory lecture period to ensure that writers received feedback that was directed to enhance and change each writer's position (Timmerman & Strickland, 2006). Peer reviewing occurred throughout the writing process rather than at the project's completion (Bos et al., 1997). Timelines for completing each peer review were clearly specified each semester for GDP Phases I and II (Appendices A and B).

During the first 3 years (2003-2005), peer review treatments of GDP Phase I were conducted as double-blind reviews (i.e., each reviewer did not know whose application he or she was reviewing and vice versa; see Appendix A; McNutt et al., 1990) while peer review on GDP Phase II was not blinded (each reviewer reviewed the same authors' GDPs as in Phase I and could recognize the earlier papers they reviewed; Appendix B). During 2006-2007, none of the GDP Phase I peer reviews were double-blinded due to the findings of the 2003-2005 peer reviews (see results). In all instances, the peers being reviewed were in the same laboratory group that worked together on lecture/lab projects for the duration of each semester. Students had been randomly chosen for each laboratory group. Thus, the multiple reviewer choice was completely randomized within each year's student population.

Students were instructed that the purpose of each peer review was to improve the quality of all projects, as well as to engage them in critical review and thoughtful discussion by role-playing as the Floratech Bank Loan Officer. The professor and teaching assistants provided background information on how bank loan officers operate. Additionally, to determine financial viability and a proposal's merit, students

determined (1) whether the proposed business operation was adequately conceptualized and developed; (2) if the plan was strategic, unique, or creative; and (3) whether adequate contingency plans were incorporated in case of failure. Specific instructions for completing the peer review critiques and the questions posed for Phase I proposal were created to ensure that all students used uniform procedures to complete their critiques (Appendix A). Phase II peer review critiques followed a similar procedure, but several questions were modified or inserted to reflect the guidelines for this phase (Appendix B). Students were informed that peer review activity was not going to be graded (although students received credit for participation). Instead, these activities were intended to improve their ability to revise their work and would then, ultimately, result in improved project grades.

Peer Review Process

The time involved in introducing students to the peer review process, conducting the peer review sessions and providing follow-up activity occurred in lecture periods, although the topics and content covered by NPR control and PR treatment groups remained the same. Peer review groups who missed content due to spending lecture time on peer reviews had the missed lectures rescheduled for laboratory times during the same weeks to ensure equal content delivery as NPRs. In addition, the PR groups received one lecture devoted to introducing the students to the peer review process for GDP Phase I (peer review critique background/instructions) with examples of acceptable and unacceptable writing and editing modeled by the professor (Flash, 2002; Appendix A). Acceptable ($\geq$ 70% score) and unacceptable (< 70%) writing was delineated using the three grading rubrics (provided to the students in week 1), which were designed for each of the GDP Phases (Appendix C).

On days when peer reviews were conducted, participating students received two pre-selected students' work (the other students in their lab group), along with instructions and forms, at the start of lecture. For the double-blind reviews, the names and other identifiers were blacked out prior to photocopying to make then non-discernable. Each student had exactly one week to complete their two peer reviews using the peer review critique forms (Appendices A and B, respectively). At the end of each in-class peer review panel, graded papers were returned to each student.

During the in-class peer review panels, the professor and teaching assistants would walk through the rooms and listen briefly to each panel review to ensure students were staying on task. To encourage student participation in the peer review treatment, failure to conduct each review meant exclusion from

class on the day of the in-class peer review panels as well as no credit for participation and a 50% point reduction in their respective graded score for the missed peer review phase. To receive credit, students turned in GDP Phases II and III along with their colleague's peer reviews from the previous phase. They also submitted a Revision Memorandum (Flash, 2003) on which they indicated changes that had been made and the ways they thought their writing had improved. These scaffolded peer reviews were designed to (a) test their effectiveness in writing improvement; (b) promote experiential editing, reviewing, and proofing of peers' writing; (c) role-play the Floratech National Bank Loan Officer to enhance learning; (d) enhance student's benefit from their peer's ideas (cross-training); and (e) improve the overall quality and professional appearance (Appendices A and B).

Measures

The following measures were employed to test the validity of the peer review process throughout the duration of each year. Multiple peer reviewer choice was completely randomized within each year's student population of the PR groups to prevent bias between student colleagues. We used unbalanced, general linear model ANOVAs to test student final grades between NPR (2000-2002) and PR (2003-2007) years. Unbalanced repeated measures ANOVAs of professor/TA graded phase scores between NPR and PR groups were used to determine if/or when peer review was effective in improving student performance in GDP Phases I through III. Tukey's HSD tests were used to delineate mean response differences between treatments. Responses to and chi-square statistical tests (1:1, 1:1:1, χ^2) for nonparametric questions GDP peer review Phases I and II critiques tested the responses for greenhouse operations matching the specifications or project greenhouse fundability. Correlations of mean GDP Phases I and II peer review scores and fundability with the instructor's grades determined if these were influential.

Data Analyses

Similar to that of Yankulov and Couto (2012), both NPR and PR group papers were edited and graded by the professor and TAs, all of whom were highly skilled writers and reviewers. Grading was independent of the non-peer review/peer review process and all graded scores were final, regardless of peer reviewer scores. The same instructor conducted the course for all years, while the TAs changed each year. Since the instructor had taught Greenhouse Management previously, any changes in potential responses gauged are most likely not attributable to maturation of instructor delivery or

content refinement. Each PR treatment group also had their papers peer reviewed twice by multiple students. To assess the peer review process, we analyzed project and final grades received by students in each group. In addition, peer review students' evaluations of the process at the end of each semester were analyzed. In these evaluations, students answered five to six questions pertaining to the GDP I and II peer reviews and enrollment in a WI class. During the years of double blind peer reviews (2003-2005), question 4 (below) was included.

1. What did you learn from peer reviewing (blind reviews) other student's Phase I Greenhouse Design Project?
2. What types of things did you learn in your peer review session as your colleagues discussed your Phase I proposal?
3. How did role-playing the loan officer for Floratech National Bank aid you in the review/revision process?
4. Rate whether you think the peer review process in Phase I (blind reviews) versus Phase II (not blind) differed. (Ratings: no difference/the same or big difference)
5. Name one effective thing about the editing/revision process (Phases I, II, III) for the Greenhouse Design Project.
6. Describe how your writing has changed as a result of enrolling in a Writing Intensive class.

All students in both the NPR and PR treatment groups received professor/TA comments and grades at the same time (i.e., 1 week after they were due). The same level of detail was provided for both NPR and PR group student papers. Additionally, identical grading rubrics were used for each GDP phase (rubrics not shown). Professor and teaching assistant graded scores for all GDP I through III projects were used to compare performance between the NPR and PR groups to test whether the peer reviews had an effect and, if so, during which phase(s) of the GDP. GDP Phase I was worth 50 points, while GDP II and III were each worth 100 and 175 points respectively. Grading rubrics for each phase were supplied to the students at the beginning of each semester to clarify the essential components. Data was collected for each participating student from each peer review critique for Phase I and II projects.

All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS Version 19). To answer the question whether peer review had an effect on student's final grades, an unbalanced, general linear model (GLM), univariate ANOVA was performed with mean separations using Tukey's HSD test at $\alpha = .05$. Tests for normality, independent observations, and equal variances were performed prior to analysis. GDP Phases I, II, and III graded scores as fractional values (score/total possible points for each phase) for the control and treatment groups were analyzed using an unbalanced, repeated measures ANOVA (mixed effects model). ANOVAs were performed on numeric scores for student's answers to all quantitative peer review questions (*i-viii*, question 4, Phase I, Appendix A and question 7, Phase II, Appendix B) with years (Yr), phases (Ph), and students (S) being the main effects and interactions of Yr x Ph, Yr x S, Ph x S, and Yr x Ph x S. Since students were asked different questions during each peer review, these data were not repeated measures. Data were pooled based on significance of the main effects. Student categorical (non-parametric, non-repeated measures) responses to questions regarding whether the greenhouse operation matches the Floratech National Bank Loan specifications and fundability (questions 2 and 8, respectively; Appendix B) across 5 years (2003-2007) posed in the Phase II peer reviews were tabulated and tested for goodness of fit using a 1:1 Pearson's chi-square test (χ^2) for yes/no answers to question 2 and a 1:1:1 χ^2 for question 8. The χ^2 test ratios assume that, by chance, the data follow a specified distribution (i.e., there is an equal probability of each answer for each respective question; Snedecor & Cochran, 1989). A $\chi^2 = 3.841$ is the critical value for rejecting the null hypothesis at $\alpha = .05$ for the 1:1 χ^2 ($df = 1$) whereas the critical value for the 1:1:1 $\chi^2 = 5.99$ ($df = 2$). On a per student basis for each peer review test year (2003-2007), grand mean Phase I reviewer scores/student (pooling all scores from all reviewers/student for *i-viii*, question 4, Phase I, Appendix A and question 7, Phase II, Appendix B) were correlated with professor's/teaching assistant grades for Phase I for each particular student; the same was done for mean Phase II reviewer scores, while the numeric funding score (1-3 scale; Question No. 8, Phase II PR; Appendix B) was correlated with the student's final grade for GDP Phase III.

Results

Student final course grades for all main effects in the ANOVA (years, PR/NPR, and Yr x PR/NPR) were significantly different (Tables 1 and 2). Interestingly, final grades for the NPR years were significantly lower than all other years of PR (Table 1). However, in NPR year 2002, the final grade score (81.7%), while still lower than all other PR years, overlapped with PR years 2003 to 2005 and 2007 using Tukey's mean separation test (Table 1). Mean separations of peer reviewing in 2003 through 2006 overlapped with NPR 2002; only final course grades for PR in 2006 (Table 1) were significantly higher than all NPR years. Overall, NPR final grades were significantly lower than PR years.

Table 1
Students' Final Grade Comparisons and ANOVA for Non-Peer-Reviewed and Peer-Reviewed Years

Year	Non-peer-reviewed	Peer-reviewed	Final grades M (SD)
2000	x		$0.633 (0.019)_a$
2001	x		$0.590 (0.020)_a$
2002	x		$0.817 (0.019)_b$
2003		x	$0.875 (0.020)_{bc}$
2004		x	$0.891 (0.020)_{bc}$
2005		x	$0.850 (0.018)_{bc}$
2006		x	$0.922 (0.017)_c$
2007		x	$0.827 (0.019)_b$

Note. Mean separations within columns are based on Tukey's Honestly Significant Difference (HSD) test, α = .05.

Table 2
ANOVA for Student Final Grades in Non-Peer-Reviewed (2000-2002) and Peer-Reviewed (2003-2007) Years

Source	df	F	η	p
Year	6	15.47	.11	< .001
PR/NPR	1	146.29	1.54	< .001
Year x PR/NPR	5	26.65	.28	< .001

Note. An unbalanced, general linear model (GLM) ANOVA was used for the analysis.

Graded GDP Phases I through III were not significantly different between years and were, thus, pooled (Table 3). This lack of significance indicates similarities among enrolled student groups. Other main effects were significant (i.e., phase grade and NPR/PR treatment groups; Table 3). These differences were attributable to the significant increase in peer review scores for GDP Phase III over all other GDP Phases (Table 4). The NPR and PR group graded scores for Phases I and II were not significantly different. However, Phase III PR group scores were significantly different from Phase III NPR group scores (Table 3). Thus, the significant effect of peer reviewing was not evident until Phase III, after two peer reviews had been completed. It would not necessarily be expected that earlier peer reviews (particularly GDP Phase I) would have as much effect on student performance, as student writing had not yet benefited from the peer review process. Apparently the peer review GDP I effect on Phase II grades was minimal and, thus, not significant (Tables 3 and 4).

Quantitative scores of peer review critiques for proposal ratings to guide authors in their revision (Appendices A and B) were significantly different between years (2003-2007) for part *i* ("The writing style is appropriate for a bank loan")*, iii* ("Proposal is coherent within/between paragraphs"), *iv* ("The writing style is appropriate for a bank loan"), and *v* ("The proposal is written in a smooth, narrative fashion"; Table 5). The remaining questions (i.e., *ii*: "A clear picture of the site for the greenhouse is provided" or "A

clear, to-scale drawing of the operation is provided"; *vi*: "The proposal is well organized"; *viii*: "The supporting documentation is concise and easy to read") were not significantly different between years (Table 5). Other main effects (phase, student) differed significantly for all parts except for parts *vi* and *vii* ("The supporting documentation is concise and easy to read") for students (Table 4). All Yr x S interactions were significant (Table 5), whereas the remaining interactions were non-significant with the notable exception of part *ii* for the three-way interaction Yr x Ph x St. Thus, the most significant effect on two- and three-way interactions to these peer review questions was the differing student populations taking the course. Mean scores for peer review critiques for question 4 in Phase I and question 7 in Phase II were in the score range of 3 (*adequate*) to 5 (*outstanding!*; Table 6). For part *i*, only 2004 Phase I and II mean scores differed significantly (Tukey's mean separation). As answers to part *ii* were not significantly different between years, values were pooled whereupon Phase I and II scores were significantly different (Table 6). Scores for the other parts varied along these score ranges. Exceptional differences from these trends were for *vi* (The proposal is well-organized) where both years and phases were not significant and *viii* (The overall description of the market and crops is thorough vs. The proposal has improved in quality after Phase I revision) where scores for years were not significantly different while the phases were. Writing significantly improved from Phase I to II for *viii* (The overall description of the

Table 3

Unbalanced Repeated Measures ANOVA Between NPR and PR Groups Professor/TA Graded Phase Fractional Scores (Scores/Total Points) Over Years and to Determine if/or When PR Was Effective in Improving Student Performance for the Greenhouse Design Project Over Phases I-III

Source	df	F	η	p
Year	1	1.37	.02	.24
Phase grade	2	624.08	10.65	< .001
NPR/PR	1	21.71	.37	< .001

Note. NPR = non-peer-reviewed (years 2000-2002); PR = peer-reviewed (years 2003-2007).

Table 4

Fractional Mean (± SD) Professor/TA Graded Phase Fractional Scores (Scores/Total Points) Over Years and Unbalanced Repeated Measures ANOVA Between NPR and PR Groups to Determine if/or When PR Was Effective in Improving Student Performance for the Greenhouse Design Project Over Phases I-III

Phase	2000-2002 NPR fractional scores M (SD)	2003-2007 PR fractional scores M (SD)
I	$0.835 (0.189)_a$	$0.858 (0.136)_a$
II	$0.786 (0.234)_a$	$0.826 (0.179)_a$
III	$0.665 (0.177)_a$	$0.869 (0.169)_b$

Note. NPR = non-peer-reviewed (years 2000-2002); PR = peer-reviewed (years 2003-2007). Mean separations for NPR/PR scores are based on Tukey's HSD test at α = .05.

Table 5

ANOVA for Peer Reviews (I, II) Proposal Rating Questions to Guide Authors in Their Revisions with Quantitative Scores of Peer Review Critiques[a] ("Rate this Proposal Below by Circling the Appropriate Score to Guide the Author in His/Her Revision") for Intensive Writing Exercises in Greenhouse Management, Pooled Across Five Years (2003-2007)

Question(s)	Year (Yr)	Phase (Ph)	Student (S)	Yr x Ph	Yr x S	Ph x S	Yr x Ph x S
i. The writing is concise and to the point	**	***	***	ns	***	ns	ns
ii. A clear picture of the site for the greenhouse is provided[b] / A clear, to-scale drawing of the operation is provided[c]	ns	*	**	ns	***	ns	***
iii. Proposal is coherent within/between paragraphs	**	**	***	ns	**	ns	ns
iv. The writing style is appropriate for a bank loan	***	****	**	ns	***	ns	ns
v. The proposal is written in a smooth, narrative fashion	**	***	*	ns	***	ns	ns
vi. The proposal is well-organized	ns	ns	***	ns	****	ns	ns
vii. The supporting documentation is concise and easy to read	ns	*	ns	ns	***	ns	ns
viii. The overall description of the market and crops is thorough[b] / The proposal has improved in quality after Phase I revision[c]	ns	***			***	ns	***

Note. N = 159 students. ns = not significant.
[a] Numerical scores: 1 = *not working*; 2 = *needs extensive revision*; 3 = *adequate*; 4 = *strong*; 5 = *outstanding!*
[b] Question asked for Phase I peer review critiques (Appendix 1).
[c] Question asked for Phase II peer review critiques (Appendix 2).
*$p \leq .05$. **$p \leq .01$. ***$p \leq .001$.

Table 6

Mean, Pooled Scores and Their Significance (ANOVAs) of Phases I, II Ratings to Questions with Quantitative Scores[a] of Peer Review Critiques (Appendix 1, Question No. 4, Phase I; Appendix 2, No. 7, Phase II) for Intensive Writing Exercises in Greenhouse Management, Pooled Within and/or Among Five Years (2003-2007)

Question posed	Phase	2003		2004		2005		2006		2007		Pooled	
		Score	*p*	Score	*p*	Score	*p*	Score	*p*	Score	*p*	Score	I/II *p*
i. The writing is concise and to the point	I	3.9		3.8		4.0		3.7		3.8			
	II	4.0	ns	4.3	***	5.0	ns	3.9	ns	4.0	ns		
ii. A clear picture of the site for the greenhouse is provided	I	3.6		3.5		3.8		3.8		3.8		**3.7**	
	II	3.7	ns	3.4	ns	3.7	ns	3.8	ns	3.6	ns	**3.6**	*
iii. Proposal is coherent within/between paragraphs	I	3.8		3.8		4.1		3.7		3.8			
	II	4.0	**	4.0	ns	4.1	ns	4.0	*	4.2	ns		
iv. The writing style is appropriate for a bank loan	I	3.6		3.6		4.0		3.5		3.8			
	II	3.9	**	4.0	ns	4.1	ns	3.9	*	4.2	ns		
v. The proposal is written in a smooth, narrative fashion	I	3.6		3.8		4.0		3.8		3.9			
	II	3.9	**	4.3	**	4.2	ns	3.9	ns	4.2	ns		
vi. The proposal is well-organized	I	3.8		3.8		4.0		4.0		4.1			
	II	4.1	*	4.0	ns	4.1	ns	4.1	ns	4.1	ns	**4.0**	**ns**
vii. The supporting documentation is concise and easy to read	I	3.6		3.5		5.0		3.7		3.5		**3.6**	
	II	3.8	ns	3.9	ns	4.0	ns	3.9	ns	3.7	ns	**3.8**	*
viii. The overall description of the market and crops is thorough; The proposal has improved in quality after Phase I revision	I	3.7		3.5		3.7		3.7		3.8		**3.7**	
	II	4.1	**	4.2	***	4.1	**	4.1	**	4.1	ns	**4.1**	***

Note. $N = 159$. Pooling within each question and among years for Phases I, II or both (I/II) were performed if main effects were non-significant (Phase I, II or Yrs; Table 2, ANOVAs) and are highlighted in **bold**. [a] Numerical scores: 1 = not working; 2 = needs extensive revision; 3 = adequate; 4 = strong; 5 = outstanding! ns = Not significant. *$p \leq .05$. **$p \leq .01$. ***$p \leq .001$.

market and crops is thorough . . .) in all years except 2007 (Table 6). The year 2003 had the highest proportion of significantly different scores between Phases I and II for *iii* through *vi* (Table 6).

Nonparametric responses to questions posed in the Phase II peer review critiques, regarding whether or not the greenhouse operations matched the Floratech National Bank Loan specifications (question 2) across peer review years (2003-2007), were predominantly positive. In no year for any question was there a 100% affirmative response (Table 7). Answers to the question "Are the pad/fan and bench layouts correct?" ranged

from 54.0% to 83.9% (Table 7) and, in one year (2003), the 1:1 chi-square test was not significant (Table 7).

Rating the proposals in Phase II peer reviews for funding potential did not fit the 1:1:1 chi-square test (Table 8). The majority of proposals were rated a score of 2. With the exception of one question in 2003 ("Are the pad/fan and bench layouts correct?"), there were no differences between years for student responses to these yes/no or rank scoring questions, as all were significantly different (Table 7). However, in all subsequent years (2004-2007), responses matched the trend for all other questions and years by being significantly different.

Correlations of peer reviewed student reviewer scores with professor/TA grades for GDP Phase I papers were low but significant (Table 9). This clearly demonstrates that in Phase I, there was no impact of peer review on student grades. As this was the first peer review session, students were learning about the process and the graded papers did not reflect this first peer review session. This trend changed dramatically for Phase II and the funding score correlations with grades; none were significantly different with the exception of 2006 (Table 9). Thus, overall there was a positive effect of the peer review process on student reviews for the majority of years, aligning closely with that of the professor/TAs. Correlations of funding (1-3 scale) with final project grades (Phase III) were significant for only 2 years (Table 9). The majority of non-significant reviewer score and GDP Phase II grades or Phase III funding correlations demonstrate that peer reviewing allowed students to comprehend the GDP requirements and tailor their writing to improve their grades on the Phase II paper.

Peer reviewer course evaluations generated a variety of student responses. For question 1, "What did you learn from peer reviewing . . . other student's Phase I Greenhouse Design Projects?," a typical response was, "It was nice to compare and contrast various ideas and approaches to designing the first and most overwhelming stage of the project." Also common was that they "learned how to observe things objectively and think critically about the presentation of information and how it affects" the Bank Loan Officer. Others commented on the advantages of seeing their colleagues' work which gave them new ideas to develop "more in-depth and comprehensive projects," helping them to "reflect on their own writing," forcing them "to be more complete" with their own projects (particularly when they were "unprepared"), helping them to see "other people's mistakes [which] made them see their own more easily," generally "learning how critical a reviewer can be," and perceiving the peer review panels as "fun."

The opportunity for outside opinions and the "rationale for the greenhouse location, market, and crop

choices gave in-depth reasoning" were typical responses given to question. 2 ("What types of things did you learn in your peer review session as your colleagues discussed your Phase I proposal?"). Others learned that they were "too wordy" and/or "wrote in incomplete sentences," and their peers "were able to catch flaws" or had "ambiguous language" the writer was unaware of. They also "learned how to make criticism and discuss the papers in such a way that doesn't attack the author or hurt someone's feelings," and that they "needed more in-depth writing" to write in the discipline.

For the majority of students, role-playing the bank loan officer (question 3) allowed the students to "better understand how imperative it [was] . . . to have things clear, concise, and interesting," provided a "real-life perspective" or "constructive criticism," and promoted critical thinking and "objectively viewing [their own] writing." A small portion of students (i.e., one to three students per year) saw no value in this role-playing exercise at all.

Interestingly, a majority of the students (91% in 2003, 87% in 2004, and 84% in 2005) felt that there was no difference between the anonymous (Phase I) and non-anonymous (Phase II) peer reviews (question No. 4). Thus, we dropped the blind reviewer aspect of Phase I peer reviews during 2006 and 2007. When we designed the peer review process for Phase I, it was patterned after similar formats of author anonymity in peer review grant panels or many scientific journal manuscripts during the review process. Our undergraduates did not perceive any added benefit from anonymity. Many commented that they were relieved to finally learn who the authors were in the peer review sessions to enhance constructive criticism and foster idea exchange. It is unclear whether the inclusion of peer review panels, wherein the reviewers met and talked with the authors (after completing their reviews), may have affected their perceptions.

Typical comments regarding one effective thing about the editing/revision process (question 5) included: "Each time we revised each other's papers, we were more knowledgeable and could help more"; "It forces decision-making" without having to "keep rewriting the entire paper"; and "Different views and angles on business from other students, along with the combined knowledge of all, gave everyone a more coherent plan." Verbalizing comments—particularly positive ones—during the peer review panel sessions were more effective for some students. Guiding the students to read the papers first before making comments was also a useful tip in editing. Several commented on how the challenge of incorporating other reviewers' comments into their rewritten proposals, while keeping it in the author's voice, aided them later when summarizing scientific literature—without plagiarizing—in this and other class papers.

Table 7

Responses (% of Student Responses) to and Chi-Square Statistical Test (1:1 χ^2) for Yes/No Questions Posed in Phase II Peer Review Critiques Regarding the Greenhouse Operation Matching the Floratech National Bank Loan Specifications (Question No. 2: "Does the Phase II Drawing of the Greenhouse Operation Match the Specifications?") Across Five Years (2003-2007) for Greenhouse Management

Questions posed	Response; 1:1 χ^2	2003	2004	2005	2006	2007
Is it to scale, with the scale indicated?	Yes	79.4	73.9	89.8	93.1	80.5
	No	20.6	26.1	10.2	10.9	19.5
	χ^2	12.6***	10.5***	31.0***	39.1***	15.2***
Is there at least 50,000 ft^2 of greenhouse growing area?	Yes	88.7	86.9	88.2	93.8	90.5
	No	11.3	13.1	11.8	8.2	9.5
	χ^2	20.8***	25.1***	29.8***	49.9***	27.5***
Is the N/S direction indicated?	Yes	83.9	83.3	86.3	89.5	87.8
	No	16.1	16.7	13.7	10.5	12.2
	χ^2	15.1***	21.3***	26.8***	41.9***	23.4***
Are the pad/fan and bench layouts correct?	Yes	54.0	82.6	78.3	83.9	71.4
	No	46.0	17.4	21.7	16.1	28.6
	χ^2	0.3ns	19.6***	14.7***	28.4***	6.4***
Are the heating/cooling calculations correct for this range?	Yes	83.6	74.4	86.4	82.2	67.5
	No	16.4	25.6	13.6	17.8	32.5
	χ^2	15.1***	10.3***	23.3***	25.8***	4.6**

Note. ns = not significant.
***$p \leq .001$.

Table 8

Student Responses (%) to and Chi-square Statistical Test (1:1:1 χ^2) for Question Posed in Phase II Peer Review Critiques Regarding the Greenhouse Fundability (Question No. 8: "Lastly, Rate this Proposal for Funding at this Phase") Across Five Years (2003-2007) in Greenhouse Management Class

Score, questions posed	2003	2004	2005	2006	2007
1, Not fundable—needs significant revision & more thought	4.8%	12.2%	7.3%	9.0%	5.5%
2, Good proposal, needs more work to make this competitive	69.8	59.2	69.0	59.1	75.0
3, Funded. An excellent loan application	25.4	28.6	23.7	31.9	19.5
1:1:1 χ^2 test	20.7***	16.7***	31.7***	24.8***	29.2***

Note. ***$p \leq .001$.

Table 9

Correlations and Significance of Mean Phases I, II Reviewer Scores and Fundability (Pooled Within Years for All Students' Scores) with Professor's Grades for Phases I, II, and III, Respectively

		2003		2004		2005		2006		2007	
	Phase	*r*	Final Grade	*r*	Final Grade	*r*	Final Grade	*r*	Final Grade	*r*	Final Grade
Reviewer scores	I	0.28*		0.44*		0.45*		0.37*		0.43*	
	II	0.21ns				0.29ns		0.52**		0.1ns	
Funding score	--		0.16ns	0.14ns	0.56*		0.2 ns		0.6**		0.4 ns

Note. ns = not significant.
*$p \leq .05$. **$p \leq .01$.

A majority (62% in 2003, 52% in 2004, 74% in 2005, 80% in 2006, and 91% in 2007) of the students attributed their change (i.e., improvement) in writing to be the result of enrollment in a Writing Intensive class such as Hort 3002W (question 6). In the present study, typical student comments in this category included that they were "more deliberate," "more confident," understood "the necessity of proof-reading," became a "better writer because of [the experience]," and that they "never had to be more professional in [their] writing." Many commented that understanding writing to be a process, rather than a singular one-time effort would be a lifelong gift of the peer review process. Several reported that "critical thinking of professional writing" moved "to the front of their thoughts when thinking about [their] profession." The minority who felt their writing had not changed commented that they were already "good" writers, that they had already enrolled in several WI courses, or that more writing assignments should be required.

Discussion

Complete student involvement (100% for all peer reviews, reviewer panels) was most likely attributable to the institution of peer review deadlines with clearly stated consequences for not participating, as reported in previous studies (e.g., Sims, 1989), as well as the realization after the first peer review session that it enhanced critical thinking to develop "more in-depth and comprehensive projects." Only a small portion of students (one to two per semester) found the peer review to have no inherent value; such students were often highly skilled writers from previous writing courses or were adult learners. The lack of students' perceived differences between the Phases I (double-blinded) and II (non-double-blinded) reviews from 2003 to 2005, where a majority (84%-91%) felt they were no different, demonstrated that anonymity was not critical to engage in the peer reviews effectively.

Tangible and Intangible Benefits of Peer Reviewing

Many tangible benefits were in evidence from the multiple opportunities of reading colleagues' writing and participating in panel review sessions. After the second peer reviews, student writing was significantly enhanced (Tables 1-4); students quickly identified superior papers when they read or discussed them. Likewise, peer reviewing enabled students to "compare and contrast various ideas and approaches to designing," "think critically," and understand their own mistakes by reading and critiquing better proposals. Objective opinions from their peers, while often identical to those provided by the professor/TAs by Phase II, had increased validity to evoke an

enhancement to student writing. Students also gained confidence as they became experienced reviewers, noting in their evaluations that: "Each time we revised each other's papers, we were more knowledgeable and could help more." Students ascribed their improved writing to being actively involved in this Writing Intensive course where they "had to be more professional in [their] . . . writing," exuding confidence and with a more deliberate approach to writing. Of significance was the student attribution of understanding writing to be a process as a lifelong gift of the peer review process.

Similar to Sims (1989), intangible benefits occurred such as insight into how their colleagues interpreted the nature of the GDP assignment and the meaning that Bank Loan officers might derive. Transfer of new ideas or non-required items to make their bank loan applications stand out to the bank loan officers included creative business names, introductory letters, or more extensive preambles about the greenhouse operation, the crops being grown, and unique marketing strategies. Such idea transference between students is similar to that reported for chemistry students (e.g., Alaimo, Langenhan & Loertscher, 2007) and reinforces the perspective that learning is a social, participatory science (Wenger, 1998). This informational transfer significantly reduced the frequency of students questioning what the bank loan officers (i.e., professor/TAs) wanted in each proposal. Likewise, as reported previously by Hsvitfeldt (1986) and Sims (1989), the thoroughness of student reviews allowed for the identification of weak logic structure. The realized time savings for the professor/TA were redirected to writing improvement and the integration of higher scientific quality in the proposals.

Lag Time Before Student Grades Reflect Peer Review Effects

Almost without exception, by Phase II the students had grasped the peer review process and had matched their editing skills and critiques of quality writing in the discipline with that of the instructor/TAs. Eventually this resulted in higher graded scores for the peer review Phase III papers. This infers that students learn the reviewer function and quality writing recognition before it translates directly into improving their own. Thus, multiple peer review opportunities must be provided throughout a course to have an effect.

A lag time occurred before the effects of peer review translated into higher GDP grades, since only in Phase III scores did the peer review scores significantly exceed the non-peer reviews (Tables 3 and 4). It would not be expected that Phase I grades would differ, as neither section of students (NPR, PR) had been exposed to peer reviewing prior to this course. The speed at

which student reviewer scores matched those of the professor/TA grades occurred by Phase II in the majority of peer review years (Table 9). Thus, students quickly learned the peer review process and scored their colleagues in a similar manner as the professor/TA. The lack of a significant year effect for any of the phases (including Phase I) further supports this. We would have expected Phase II grades for the peer review years to be significantly higher than non-peer review years, but this did not occur. The demonstrable effect of peer review did not appear until Phase III. Even though all peer review scores were higher than corresponding non-peer review values, apparently students needed to experience two peer reviews for this GDP assignment to manifest significant change in writing and improved performance. This further emphasizes the continued use of peer reviews during the entire semester to reinforce and improve writing skills. One peer review session per course is insufficient for students to learn the editing/reviewer process and become better writers.

Content and Syntactical Function

Content is still an important component of WI courses, and Greenhouse Management is no exception. Emphasis of content and syntactical function during these Hort 3002W peer reviews is a new focus for the peer review process because, in most studies, content may represent as little as 20% of the peer review evaluation (Billington, 1997). In our original design of the peer review component in this course, we intentionally reassigned critical lecture content to laboratory sessions such that both NPR and PR groups received identical course content. Embedding the importance of content as well as enhancement of writing skills into the peer review process provided constant focus on both attributes. In addition to providing equal content between years, this balanced approach demonstrated that an increase in syntactical function in peer review does not have to sacrifice content. Both aspects complementarily made peer review the most powerful learning tool in this course.

Differences in student writing over years continued to have a significant effect during the peer review process where quantitative scores of peer review critiques for question 4 in Phase I and question 7 in Phase II, which referred to writing quality (parts *i, iii, iv, v*) differed significantly between years (2003-2007; Table 5). Such questions, related to writing style or overall quality, were significantly different between phases, indicating improvement in the coherence of the proposals, writing styles, narrative fashions, organization, and thoroughness. Similar results have been reported previously (Hsvitfeldt, 1986; Sims, 1989). Those parts relating to the incorporation of supportive documentation (parts *ii, vi*) were not significantly different between years (Table 5),

which confirm that the student populations remained consistently able to follow instructions for the GDP and supply requested information. In most instances, Phase II scores for questions *i, ii, iii, iv, v, vii,* and *viii* significantly increased over Phase I (Tables 5 and 6), which reflects an increased syntactical function of peer reviews (Carlsen et al., 2001) and provides pertinent reviewer feedback (Timmerman & Strickland, 2006). As our student populations consisted of younger and older generation enrollees, this age difference may have been a significant effect on two- and three-way interactions (Table 5) because the older generation students were predominantly skilled writers. Additionally, significant yearly differences in the overall student enrollees' writing ability indicate that the student population's skill level in writing varies widely each year.

The Power of Peer Reviewing

A majority of the students attributed their change (i.e., improvement) in writing to be the result of enrollment in a Writing Intensive class. These results are consistent with the findings of Brumback, Squires, and Parrish (1985) where 70% of the students responded affirmatively when asked if the writing assignments improved their writing. In the present study, student comments regarding the power of peer reviewing in enhancing their learning trajectories were similar to those reported by Blair, Cline, and Bowen, (2007), for example, that they were "more deliberate" writers, that they were "more confident," that they understood "the necessity of proof-reading" and were "better writer[s] because of it." Many commented that understanding writing to be a process, rather than a singular one-time effort, would be a lifelong gift of peer reviewing.

Limitations

The need for a control group each year the peer review was performed, while not possible to institute in this course, would be an important component in future horticulture courses with multiple sections. While controls have not always been included in previous studies either (Yankulov & Couto, 2012), they may have accounted for inherent biases that may have occurred due to professor familiarity with the GDP assignment (e.g., the increased score in the 2002 NPR group). Lower grades in the control group herein were not due to the instructor's unfamiliarity with the subject matter, since the instructor was a veteran in the subject area (as noted earlier), but they may be attributed to the enrolled students' populations.

Only in some years did the effect of peer review on students' final course grades exceed those for the NPR group (Tables 1 and 2). The overlap of mean

separations in final grades for students in the 2002 NPR group (only 1/3 of the NPR group years) with the PR group years 2003 to 2005 and 2007 may be attributable to their increased performance in other assignments to elevate their final grade. Elevated student performance in the 2002 NPR group, or later PR group years, may have been partially due to increased student or professor familiarity with the GDP assignment, although this was not tested. Teaching assistant effects were minimal as each TA only taught one year.

Similar to Yang (2011), knowledge transfer between peers was not measured, and its effects on writing improvement versus that of the professor/TAs are unknown. This would be an important factor for future studies.

Results of this study cannot be generalized beyond the populations sampled to all horticulture student populations. Since this was a required course in the undergraduate horticulture major the student populations represented the spectrum of students in nursery, floriculture, turf, fruit science, and landscape design/architecture. However, the 8-year sampling, while long-term in nature, may or may not be indicative of other populations.

Recent innovations (e.g., online *calibrated peer review*: see http://cpr.molsci.ucla.edu) that were not available during the period of the present study may enable faster accomplishment of peer reviewing within the contextual framework of this course (Likkel, 2011). Future studies in online horticulture courses could test the effectiveness of peer review within this context.

Conclusions and Implications

Peer reviewing is a time investment for both the professor/TA and students, but the rewards far outweigh time constraints. Promotion of improved writing skills, lateral thinking and lifelong learning that encourage the development of Bloom's (1956) higher cognitive skills exceeds the results of strictly content- or memorization-based education (Aaron, 1996; Anderson, 1995; MacKay et al., 1999; Moss & McMillen, 1980). Student writers applied and synthesized concepts, and they discovered conceptual relationships in this GDP writing assignment, which occurred at higher levels of cognition (Parrish, Brumback, & Squires, 1985). As Sims (1989) pointed out, conducting peer reviews required extreme organizational skills as well as inflexibility of deadlines and clearly defined consequences. Adherence to these parameters allowed for 100% student participation in the peer review process. The sociological role of peer reviews is a powerful means of enhancing student's abilities to make evaluative assessments of their colleagues' writing which enhances their own learning and expands scientific/professional writing into a social

function (Carlsen et al., 2001). We highly recommend incorporation of peer reviews into horticulture curricula. Likewise, integration of peer reviews in courses of other disciplines is highly recommended as this is highly likely to elicit equally useful and effective knowledge transference, writing enhancement and lifelong communicative learning.

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NEIL O. ANDERSON is a professor who teaches a wide range of undergraduate and graduate Horticultural Science courses at the University of Minnesota. Throughout his teaching career, Neil has sought to integrate cutting edge teaching methods to enhance student learning. The concept of incorporating peer reviewing student writing—the first formalized endeavor of its kind in the field of undergraduate horticulture courses—was created to provide alternative means of cross-learning for writing enhancement.

PAMELA FLASH serves as Director of Writing Across the Curriculum Programs at the University of Minnesota where she has taught writing and supported effective teaching since 1991. In addition to facilitating interdisciplinary workshops and faculty seminars, Flash directs the pioneering Writing Enriched Curriculum (WEC) program, a writing in the disciplines project she launched in 2007. Flash's research interests include writing pedagogy, applications of Activity Theory, and the use of qualitative research methods (particularly collaborative action research and ethnographic research) to enable pedagogic change on individual, departmental, and institutional levels.

Acknowledgments

Appendix A
Peer Review Critique Form for Student Reviews of Phase I (Greenhouse Design Project)
Conducted in Hort 3002W Class

Hort 3002W—Peer Reviews, Phase I
<u>Greenhouse Design Project</u>

PURPOSE.

The peer review process fulfills an important component of the Writing Intensive class requirement. You will serve on a panel to review your peer's projects. This peer review will be performed within each laboratory group serving as the panel for the respective group.

Overall, the purpose of this peer review is to improve the quality of all projects and engage in critical review and thoughtful discussion by role-playing as the Floratech Bank Loan Officer.

<u>This exercise will not</u> determine anyone's actual grades for Phase I—it is meant to improve your own writing skills, critique your peers, gain new ideas, and provide meaningful critiques. The professor and teaching assistant will assign the scores for your grade. You will receive credit for your participation in the peer review process.

When this exercise is completed, you will take the reviews for your proposal from your panel members and revise your Phase I draft. This revision, along with the additional components required for Phase II, and your original Phase I will be handed in together when the Phase II project is due.

THE PROCESS.

1. Each student will review two proposals from your lab group (that are not yours).
2. Pick up the two copies of proposals from your lab group that you will review. These have the names of your peers blocked out, so this phase of the review process is anonymous.
3. Review these two proposals on your own time, outside of class, during the next week, using the accompanying guidelines in your critique. YOUR REVIEWS MUST BE COMPLETED BEFORE CLASS (LECTURE) ON MONDAY, xxxxx (date). No exceptions! If you fail to do this, you will not be allowed to come to class and your Phase I score will be penalized with a 50% point reduction and you will not receive credit for the panel review.
4. FOR CLASS LECTURE ON xxxx (date), BRING THE PROPOSALS AND YOUR CRITIQUES FOR DISCUSSION. WE WILL DISCUSS EACH PROPOSAL IN PANEL REVIEWS DURING CLASS.

THE REVIEWS.

Note: We will go through an example in class today to clarify how to perform each review. As a reviewer, you will be role-playing as the Floratech National Bank Loan Officer. This will give you the opportunity to understand how the Bank Loan Officer thinks and reacts to each proposal as they cross his/her desk.

Some things to keep in mind about the Floratech National Bank Loan Officers:

*   They're busy people and want all bank loan application to have all of the necessary requirements and be "to the point". Loan officers do not have the time to sift through printouts that could have been summarized in a table.
*   Each proposal must be professional in appearance and delivery of information.
*   The Loan Officers will be looking at each proposal for ideas that make it "stand out" as a superior loan application. For instance, ask yourself whether each proposal is well thought-out, whether the plan is strategic, unique, creative, or whether contingency plans have been incorporated in case of failure.
*   These viewpoints will reflect on the anticipated potential success of the business, i.e. whether it is financially sound, competitive, etc.

Fill out the <u>Peer Review Critique</u> sheets and write a brief commentary (bullet points, if necessary) on each proposal and fill in the requested information before you bring it to your panel review in one week. There are sheets attached to use. Fill them out completely, honestly, and accurately.

Hort 3002W—Peer Reviews, Phase I
Greenhouse Design Project

Peer Review Critique Instructions

Now you have two Phase I proposals to review. Give yourself enough time to really focus on this—figure 30 minutes per proposal minimum. Remember to make your comments legible—you might want to use a pencil—and to focus on the BIG PICTURE issues rather than grammar or spelling.

The first thing to keep in mind as you read each proposal is that you will be reading and critiquing these proposals from the vantage point of the loan applicant's target audience—the Floratech National Bank Loan Officer, i.e. you are the Bank Loan Officer!! Take a couple of minutes BEFORE you read to figure out how you, as the Loan Officer, already feel about the necessary components of the Phase I Proposal. What might be your concerns, questions, or specific things that would make a proposal outstanding? Jot these things down on a piece of paper—to keep them fresh in your mind—for referral as you begin to review the proposals.

1. Begin by writing your name on the top right-hand corner of each proposal that you are reviewing. Do the same thing on the two sets of Peer Review Critiques that follow this handout. That way, if there's any confusion after the panel review session is over, your peer can contact you to clear up any unclear comment or notation.
2. Proceed with this exercise by critiquing one proposal at a time.
3. Read or scan through the entire proposal quickly. Resist the temptation to jump in with specific comments until you've read through the whole proposal once. Mark passages you think you might like to return to later—either because they are of interest or seem confusing.
4. Now go back to the beginning of the proposal and draw out/elaborate on your comments a bit further. You may write notes in the margins. As you re-read the text:
   o Underline the text that speaks to the type of business being proposed, as well as the crops to be grown.
   o Draw a wavy line underneath any sentences or paragraphs that are confusing to you. Such sentences may cause you to ask yourself "says who?" or "based on what?" as you're reading it. These are problematic areas that will need to be revised by the author.
   o Draw a box around a paragraph, sentence, or drawing that contains the most persuasive piece of the entire proposal. In other words, What would make you approve this loan? This area will be the best selling point(s)!
   o Place a star near the paragraph or section that has the most interesting information or is unique (something memorable). Possibly the author created a descriptive, yet interesting name for the business that caught your interest or attention.
5. Take a look at the evidence by re-reading the supporting documentation, i.e. the site's weather data and preliminary budget proposal. Write your comments in the margins of any page(s) to clarify any misunderstandings or areas that need more work. Again, you may draw wavy lines underneath or around such confusing or unclear sections.
6. Then answer the questions on the Peer Review Critique Sheet and rate the proposal.
7. You're done!

Appendix B
Peer Review Critique Form for Non-Anonymous Student Reviews of Phase II (Greenhouse Design Project)
Conducted in Hort 3002W Class (Appropriately Modified from Phase I)

PURPOSE.

The peer review process fulfills an important component of the Writing Intensive class requirement. You will serve on a panel to review your peer's projects. This peer review will be performed within each laboratory group serving as the panel for the respective group.

Overall, the purpose of this peer review is to improve the quality of all projects and engage in critical review and thoughtful discussion by role-playing as the Floratech Bank Loan Officer.

This exercise will not determine anyone's actual grades for Phase II—it is meant to improve your own writing skills, critique your peers, gain new ideas, and provide meaningful critiques. The professor and teaching assistant will assign the scores for your grade. You will receive credit for your participation in the peer review process.

When this exercise is completed, you will take the reviews for your proposal from your panel members and revise your Phase II draft. This revision, along with the additional components required for Phase III, and your original Phase I, II will be handed in together when the Phase III project is due.

THE PROCESS.

1. Each student will review two proposals from your lab group (that are not yours).
2. Pick up the two copies of proposals from your lab group that you will review. These reviews will not be anonymous.
3. Review these two proposals on your own time, outside of class, during the next week, using the accompanying guidelines in your critique. YOUR REVIEWS MUST BE COMPLETED BEFORE CLASS (LAB) ON MONDAY, xxx (date). No exceptions! If you fail to do this, you will not be allowed to come to class and your Phase II score will be penalized with a 50% point reduction and you will not receive credit for the panel review.
4. FOR CLASS LAB ON xxxx (date), BRING THE PROPOSALS AND YOUR CRITIQUES FOR DISCUSSION. WE WILL DISCUSS EACH PROPOSAL IN PANEL REVIEWS DURING CLASS.

THE REVIEWS.

This review will be conducted similarly to the Phase I reviews. Remember, as a reviewer, you will be role-playing as the Floratech National Bank Loan Officer. This will continue your opportunity to understand how the Bank Loan Officer thinks and reacts to each proposal as they cross his/her desk.

Some things to keep in mind about the Floratech National Bank Loan Officers:

•   They're busy people and want all bank loan application to have all of the necessary requirements and be "to the point". Loan officers do not have the time to sift through printouts that could have been summarized in a table.
•   Each proposal must be professional in appearance and delivery of information.
•   The Loan Officers will be looking at each proposal for ideas that make it "stand out" as a superior loan application. For instance, ask yourself whether each proposal is well thought-out, whether the plan is strategic, unique, creative, or whether contingency plans have been incorporated in case of failure.
•   These viewpoints will reflect on the anticipated potential success of the business, i.e. whether it is financially sound, competitive, etc.

Fill out the Peer Review Critique sheets and write a brief commentary (bullet points, if necessary) on each proposal and fill in the requested information before you bring it to your panel review in one week. There are sheets attached to use. Fill them out completely, honestly, and accurately.

Hort 3002—Peer Reviews, Phase II
Greenhouse Design Project

Peer Review Critique Instructions

Now you have two Phase II proposals to review. Give yourself enough time to really focus on this—figure 30 minutes per proposal minimum. Remember to make your comments legible—you might want to use a pencil—and to focus on the BIG PICTURE issues rather than grammar or spelling.

The first thing to keep in mind as you read each proposal is that you will be reading and critiquing these proposals from the vantage point of the loan applicant's target audience—the Floratech National Bank Loan Officer, i.e. you are the Bank Loan Officer!! Take a couple of minutes BEFORE you read to figure out how you, as the Loan Officer, already feel about the necessary components of the Phase II Proposal. What points are you looking for in the Phase I proposal revision? What might you expect in their memorandum explaining Phase I revisions versus what is in the text that demonstrates the applicant has incorporated ideas and suggestions? Jot these things down on a piece of paper—to keep them fresh in your mind—for referral as you begin to review the proposals.

Much of the review process remains the same as it was for Phase I reviews:

1. Begin by writing your name on the top right-hand corner of each proposal that you are reviewing. Do the same thing on the two sets of Peer Review Critiques that follow this handout. That way, if there's any confusion after the panel review session is over, your peer can contact you to clear up any unclear comment or notation.
2. Proceed with this exercise by critiquing one proposal at a time.
3. Read or scan through the entire proposal quickly. Resist the temptation to jump in with specific comments until you've read through the whole proposal once. Mark passages you think you might like to return to later—either because they are of interest or seem confusing.

Now go back to the beginning of the proposal and draw out/elaborate on your comments a bit further. You may write notes in the margins. As you re-read the text:

1. Draw a wavy line underneath any sentences, paragraphs, or parts of their drawings that are confusing to you. Unclear areas may cause you to ask yourself "says who?" or "based on what?" as you're reading it. These are problematic areas that will need to be revised by the author.
2. Draw a box around a paragraph, sentence, or drawing that contains the most persuasive piece of the entire proposal. In other words, What would make you approve this loan? This area will be the best selling point(s)!
3. Take a look at the evidence by re-reading the supporting documentation, i.e. the to-scale drawing of the greenhouse operation, the headhouse, parking lot. Look for the important components that are necessary in the drawings. Are the drawings easy to read and understand? Is a key supplied to aid in this process? Write your comments in the margins of any page(s) to clarify any misunderstandings or areas that need more work. Again, you may draw wavy lines underneath or around such confusing or unclear sections.
4. Then answer the questions on the Peer Review Critique Sheet and rate the proposal.
5. You're done!

Hort 3002W—Peer Reviews, Phase II
Peer Review Critique

Reviewer's Name (yours): _____

Proposal you are reviewing: _____

Answer the following questions:

1. What is the best selling point of this proposal (the area that you boxed in)?

2. Does the Phase II drawing of the greenhouse operation match the specifications? Circle your answer below for each item. You may also add comments, if you feel that is necessary.
   - Is it to scale, with the scale indicated?   YES or NO
   - Is there at least 50,000 ft2 of greenhouse growing area?   YES or NO
   - Is the N/S direction indicated? YES or NO
   - Are the pad/fan and bench layouts correct?   YES or NO
   - Are the heating/cooling calculations correct for this range?   YES or NO

3. In what way(s) does (or could) the bench system reflect space use efficiency to maximize production for this greenhouse range?

4. How did the author successfully prevent or minimize any traffic flow problems with the current bench/ground bed setup? Think about how a greenhouse worker would maneuver throughout the entire range while performing a variety of production tasks.
   a. In what way(s) does (or could) this greenhouse operation integrate modern technology to enhance overall crop production efficiency?
   b. What questions might you have for this bank loan applicant that will enable them to obtain a bank loan at Phase III? Look at the sentences that are underlined with a wavy line.

5. Rate this proposal below by circling the appropriate score to guide the author in his/her revision.
   Scores:
   1 = *not working*, 2 = *needs extensive revision*, 3 = *adequate*, 4 = *strong*, 5 = *outstanding!*

a.	The writing is concise and to the point	1	2	3	4	5
b.	A clear, to-scale drawing of the operation is provided	1	2	3	4	5
c.	Proposal is coherent within/between paragraphs	1	2	3	4	5
d.	The writing style is appropriate for a bank loan	1	2	3	4	5
e.	The proposal is written in a smooth, narrative fashion	1	2	3	4	5
f.	The proposal is well-organized	1	2	3	4	5
g.	The supporting documentation is concise and easy to read	1	2	3	4	5
h.	The proposal has improved in quality after Phase I revision	1	2	3	4	5

6. Lastly, rate this proposal for funding at this phase (check one):
   a. Not fundable—needs significant revision & more thought.
   b. Good proposal, but needs more work to make this competitive.
   c. Funded. An excellent loan application.
   What is your rationale for this rating?

Appendix C
Grading Rubrics for Phases I to III of the Greenhouse Design Project

Loan Application
to
Floratech National Bank

Applicant: _____

Phase I Scoring

Item	Points Possible	Your Score
Writing Proficiency		
Clear, concise writing	**5**	
Grammar, spelling	**5**	
Scientific accuracy, professionalism	**10**	
Market		
Market identification, type of growing facility	**5**	
Site selection:		
Correct location, accurate weather conditions	**4**	
Summation of weather parameters for ease of reading	**5**	
Economic feasibility	**4**	
Preparatory work required	**2**	
Photograph	**1**	
Crop(s)		
Number, scientific nomenclature	**5**	
Appropriateness to operation and market	**4**	
TOTAL	**50**	

Comments:

Loan Application
to
Floratech National Bank

Applicant: _____

Phase II Scoring
(Includes Revised Phase I + Phase II, as well as revision memorandum
or letter assembled into a single loan application)

Item	Points Possible	Your Score
Writing Proficiency		
Revision of previous writing assignment, Phase I	**10**	
Revision memorandum or letter	**7**	
Scientific accuracy	**5**	
Layout, Construction Considerations for a Sustainable Greenhouse Operation		
Drawings (to scale), Proper ft^2 area of greenhouses and headhouse, Future expansion direction	**9**	
Buildings (structure types, orientation)	**7**	
Glazing material(s), Irrigation system, Lighting	**10**	

Bench arrangements and type, Designation of crop production in greenhouses	**5**	
Traffic flow patterns	**5**	
≥ 100% Space efficiency and appropriateness for crop(s)	**5**	
Additional required equipment	**1**	
Work areas (offices, headhouse, etc.)	**1**	
Heating/cooling calculations, fan/pad locations (if used)	**10**	
Explanatory write-up of all layout and construction considerations	**15**	
Budget (may exceed loan amount)		
Inclusiveness (all required supplies and equipment)	**5**	
Accuracy of line items	**5**	
TOTAL	**100**	

Comments:

**Loan Application
to
Floratech National Bank**

Applicant: _____

Phase III Scoring

(Containing Phase II revisions with revision memorandum or letter which are integrated into the Phase III proposal, making one complete bank loan application.)

Item	Points Possible	Your Score
Writing Proficiency		
Revision of previous writing assignment (Phase II), revision memorandum or letter	**30**	
Introduction to the facility	**10**	
Scientific accuracy	**10**	
Budget		
Budget modifications; explain why you changed components, advantages/disadvantages of these changes, ID how these can increase/decrease profitability	**40**	
Budget within the loan amount of US$ 1 million **(see note below)****		
Layout, Construction Modifications		
Revised, detailed listing of components	**10**	
Revision to drawing, layout, if required	**10**	
1-yr. Production schedule		
Accuracy (crop production requirements, timing, harvesting)	**20**	
10% crop turnover (average) / year	**10**	
# plants/crop	**5**	
crop spacing, ≥ 100% space use	**10**	
FBI/FBD treatments and production timing to make target harvest or finishing dates	**5**	
# hours (labor) required for each crop at each production stage	**10**	

Appropriate environmental parameters necessary to grow each crop	**10**	
Employees		
# of employees required (FT or PT) to run this business	**5**	
employee job titles/duties	**5**	
estimated # employee hrs/crop	**5**	
TOTAL	**175**	

**If the budget is not within the US$1 million loan amount, your Phase III score is automatically a zero.
Comments (on verso):

Empower ESL Writing Students: Keep It Simple

Janet Francisco
Black Hawk College

This case study started when I noticed that my ESL (English as a Second Language) students from all over the world had a hard time not only adjusting their writing/textual production to the language but also to the organizational structures of the paragraph I was presenting to them in my intermediate writing class. Considering that my students need to have a real experience with the new paragraph structure and keep applying it to their writing for our 16-week class, I tried two different interventions based on several authors who emphasize the learner-centered teaching during the spring semester of 2012 at Black Hawk College in Moline, IL. The first intervention took place on the first class day when I did not introduce the paragraph model and the terminology we would adopt. I let the student write the first assignment freely; however, in our next class, we used their own paragraph to compare to the rhetorical model I was proposing. The second intervention was about making clear and precise comments on students' drafts in order to be as clear and precise as possible to keep them following the same paragraph structure model. Results and analysis of these two interventions are presented in this case study.

How hideous, unpleasant, and annoying it is when teachers write "awk," a question mark, or even "expand this idea" on the margins of students' paragraphs. Without any specific directions about what is not working, students normally tend to concentrate on editing aspects of correction such as misspelling or subject-verb agreement issues. Therefore, writing students become frustrated and start not enjoying writing. In an English as Second Language class, the writing process has two more obstacles: the English language itself and the diversity of academic writing concepts that students already possess. According to Siepmann (2006) in his article "Academic Writing and Culture," cultural influences in writing became more intensively studied some decades ago. Basically, Kaplan in the 1960s noticed that an English paragraph had linear development while a French paragraph presented much more digression. Also, digression often has a well-defined function in German academia: to prove theory, historical background or additional information to qualify preceding statements to "enter into polemics with another author" (Clyne, 1987, p. 227). In short, most of my ESL (English as a Second Language) students apply French, German, or other techniques to develop their ideas instead of the English convention. Personally, I had no problem accepting and even agreeing with this theory; however, I strove for a way or technique to provide my writing students awareness about these differences and equip them with tools to handle language both academically and effectively. Therefore, several authors were used to support this study.

Recent educational theories have emphasized the importance of placing students at the center of our teaching. It means when preparing our lessons, we change from "How will I teach this content?" to "How will students learn this content?" (Huba & Freed, 2000, p. 5). Considering my ESL writing students, I also have

to take in account what Paulo Freire (2003) stated in his well-known work *Pedagogy of the Oppressed*: the students already know "things they have learned in their relations with the world" (p. 63). In other words, as a teacher, I should bring the student to the center of my teaching and consider what my students already know (and apply) about academic writing since they are mostly adults. More specifically, besides using my students' own writing skills to present the content I wanted to propose to them, we together should re-invent the reality (Freire, 2003). However, to re-invent the reality, my writing students had to be guided with very clear and precise directions in order to adjust and combine previous and current knowledge. Brian Huot (2002) in his work, *(Re)Articulating Writing Assessment*, stated, "we need to explain as clearly as possible what we mean by awk or vag and . . . relate these explanations to other interactions" (p. 131). Even though Huot's (2003) statement might seem obvious, when dealing with English learners, it means explaining and clarifying even the facets of writings that we take for granted that our students should know.

Finally, RTI (response to intervention), which consists of a system of instructions and interventions administrated to struggling readers (and consequently writers), was also adopted as theoretical support to this study more specifically some points from Fisher, Frey, and Rothenberg's (2011) work, *Implementing RTI with English Learners*. In their work, the authors proposed some practices to get effective results. Among them, I would like to highlight two: the first one is *models*, in which students "see clear demonstrations and examples of the process or skill they will learn and the product they will create" (Fisher et al., 2011, p. 135). Second is *metacognition* in which students have the opportunity to "reflect on their learning, [be] aware of how they learn, and know where they stand in their progress toward their goals" (Fisher et al., 2011, p. 135).

In conclusion, these authors inspired me to experiment with small changes in the way I was teaching writing to English learners. First, I acknowledged they were not beginners either considering language or academic skills. Second, even though they were not beginners, they needed clear and precise guidance in order to advance. The results and analysis of employing these small changes are displayed in the next sections of this case study.

Interventions

Intervention A

I have been teaching Intermediate Writing for five years. In previous semesters, on the first day of our class, students were shown the model of paragraph they were supposed to apply for the semester. We started with an example of a paragraph that followed English standards and worked on the terminology we would be mentioning such as topic sentence, major supports, minor supports, concluding sentences, and connectors; terms that would be part of our vocabulary for 16 weeks and that many students had never heard before. I noticed that even though students seemed to understand the generic organization of a paragraph, many of them kept struggling with it for weeks. During the Spring 2012 semester and for the purposes of this case study, this introduction was not given. Students were asked to interview the classmate next to them. First, we brainstormed the possible questions we ask when we meet someone, and we created a list of questions they could use to interview their classmate. Then they had to take the information they got from the interview and put it together as a paragraph for homework. In the next class, they had to bring the first draft. The results of this first intervention are shown in Table 1, along with their analysis.

Table 1

Sample Topic Sentences—First Paragraph Assignment

Student	First draft	Final version
Student A	My partner name is ___ he is from Togo he told me that his future plans are to be a teacher, we talked about the seasons . . .	In my first day in my Writing I class, I interviewed my classmate, ___, and he told me interesting things about himself.
Student B	I interviewed ___, he said his favorite place is bagdad [*sic*]	In the first day in my Writing I class, I interviewed my classmate, ___, and he talked about three interesting things.
Student C	___ is from Mexico, and she has been living in the U.S. for two years.	On January 17th, I started my classes at Black Hawk College, [*sic*] in my ESL class I met ___ and she told me . . .
Student D	My partner ___ from West Africa future plans is to get the best degree. His favorite pet is a rabbit …	My first day of school was so interesting for me because I met a person who comes from the same country that I am from and who told me interesting things about his life . . .
Student E	One of my classmate [*sic*] is ___. She is from Brazil and it's sound interesting because she said it's beautiful.	In my first day in Writing I class, I had to interview my classmate ___ and she said me [*sic*] interesting things.
Student F	___ future plans is become a nurse, her goal is get into nursing program.	In my first day in Writing I class, I had to interviewed [*sic*] my classmate, ___, and she said me [*sic*] interesting things about herself.
Student G	My partner future plans are study to finish English class and get to college to and become a teacher.	In my first day in Writing I class, I had to interview my classmate ___. And he said many interesting things.
Student H	Today the first day of school I have ___ as partner. She comes from Mexico but was born in California. She like flowers.	I interviewed ___ during my first day in Writing I class, and I realized some interesting facts about her.
Student I	My first day at school I meet one of my classmate yours name is ___	In my first day in Writing I class, I had to interview my classmate ___, and she said me interesting about herself [*sic*].
Student J	My partner classmate his name is ___ his favorit [*sic*] time is summer.	In my first class in Writing I class, I had to interview my classmate ___ and he said interesting things to me.

When students brought their first draft, considering our learner-centered conduct in which "we should include activities and experiences that will help students acquire the knowledge, skills, and understanding that each of our learning outcomes requires" (Huba & Freed, 2000, p. 5), instead of having the peer editing step, we edited the draft as a class. In pairs, students exchanged their drafts. Before they started proofreading, I introduced them to the paragraph structure we would adopt with a model on the screen. This practice is in complete agreement with Fisher et al. (2011), that with models, "students see clear demonstrations and examples of the process or skill they will learn and the product they will create" (p. 135). Also, they started to become familiar with the terms we would use by finding each term in the paragraph model we had. After this introduction, students had enough background to analyze their classmates' drafts and their own as well. As I was presenting the model and terms, students themselves volunteered their writing issues because they started noticing that their draft was not matching with the model. At the end, the majority of the drafts had no topic sentence, and students understood that without a clear and well-developed topic sentence their paragraph would be a group of words without connection. Therefore, we developed a topic sentence for the class as a model (students were free to change words but not the controlling idea), and each student chose three points (major supports) to write about their classmate. Finally, students had the opportunity to go to their interviewees again and ask for an example of each point they had chosen to talk about, and then they created the minor supports for their paragraphs. To complete the process of giving them the real experience of how to write a paragraph, we worked with the concluding sentence to make sure they would not merely repeat the topic sentence.

Except for Student H, who shows an attempt to introduce his/her paragraph, without working with the paragraph model students started their paragraph without a topic sentence and presented their findings about the classmate as a sequence of sentences without connections.

When we edited the first draft as a class and worked on our topic sentence, we then grouped information that had connection to create major supports: classmates' favorites and classmates' goals. Then minor supports were added to each major. Afterward, we worked on the concluding sentence while emphasizing that restating the topic sentence is not literally repeating it, and being careful not to add information not discussed in the majors. It was a great experience because even though we had several issues to handle, within the following weeks of class, every single draft presented the basic structure discussed and experienced in the first class.

To conclude this part of the intervention, as a teacher I had to respect the opinions my students already had about "good" academic writing because according to Freire (2003), we cannot expect positive outcomes if we fail to respect students' particular view of the world. After all, we had to re-invent reality together (Freire, 2003). For these reasons, during the Spring 2012 semester, the Intermediate Writing class started from the students' view and understanding of a paragraph that stimulated their "'perception of the previous perception' and 'knowledge of previous knowledge,' decoding stimulates the appearance of a new perception and the development of a new knowledge" (Freire, 2003, p. 115). In other words, students could compare by themselves the points in their writing that were not fitting in the new model of writing I was proposing, but at the same time they felt they were completely able to adjust to the "new reality" they were being presented. In the following drafts, the topic sentences and the major supports were frequently shown in students' writings, and they had to handle less and less with structure and more with ideas during the semester.

Intervention B

The second part of this case study embodied Huot's (2002) suggestion of clarity and precision on our comments on our students' drafts, Fisher et al. (2011) practices in which instructions that focus on language have to be explicit, and Freire's (2003) *praxis* in which students had the opportunity to reflect on what they were learning and how that would affect their life in society. First, it is important to explain the writing process adopted in our class. It contains nine steps, and in the first week of class students are introduced to it. The process is as follows:

1.   Give the general topic
2.   Brainstorm the topic
3.   Outline basic structure of the paragraph (e.g., a topic sentence, three majors with two minors or so supporting the majors, and a concluding sentence)
4.   Write first draft
5.   Review with peer
6.   Write second draft
7.   Review from teacher
8.   Write third draft
9.   Grade

In the intermediate level, our students start working with paragraphs. For this particular class, students have six paragraph assignments that will follow every step proposed in our writing process. At the end of the semester students start working with essays.

Simultaneously to developing paragraphs, students review some important grammar points in order to improve their sentence skills. Normally, all steps of the writing process follow nicely and with good results. While brainstorming the topic, most students volunteer to share their ideas; during outline, students loudly share their major and minor supports. However, in previous semesters, when we had the peer review step—the time in which students were paired to share their first drafts and get and give some feedback to their classmate—students became not so willing and not encouraged anymore. For that particular semester, Spring 2012, after the first experience of peer reviewing as a class, we tried to apply the same technique as much as possible. Students were paired, but they could share their judgment of proper topic sentence, effective major and minor supports, and an adequate concluding sentence. This change in approaching peer review alleviated the tension and stress on students because they were not responsible for commenting on their classmates' writing alone anymore. They could share questions and suggestions. The peer editing as a class showed students the real concept of collaboration: each one of them knew little pieces of the puzzle that they could share toward completing the big picture.

After the peer review step, students have to turn in the second draft including the comments and suggestions in the next class as a homework assignment. I take the drafts home and review them one by one. I created different tables for each type of paragraph students would be working on during the semesters. A sample of one of these tables is presented in Table 2.

The left column contains the points students should have in their draft paragraph; in the right column, I would write my comments and suggestions, so students could be able to fix the issues. Then, I returned the second draft along with these comments. Using these tables when reviewing my students' second draft, I implemented Huot's (2002) suggestion of clarity and precision, emphasizing not only language explicit instructions (Fisher et al., 2011) but also structure, applying Freire's (2003) statement of combining previous and current knowledge in order to create a new reality. For instance, if a student's writing had a major without a minor support, I suggested that the student write about an example in his/her family. If the topic sentence was not developed in one sentence, I suggested that the student combine majors and present them in the topic sentence, and so on, as our form contains around eight items to be discussed. In the next class, the draft and the form are returned, and students have time in class to read and ask questions about the comments. Therefore, the teacher editing on the second draft goes beyond the editing aspect; in other words, grammatical errors are pointed out, but rhetorical issues are approached with clear and specific directions on how to have them fixed.

For this case study, only students who followed all of the steps of the writing process proposed and

Table 2
Sample Form for Persuasive Paragraph Second Draft Teacher Review Comments

English standard	Objectives	Comments
Topic Sentence	"Should" included? Opinion about the topic is clear?	
First Major support—clear	a. Minor support b. Minor support Minor supports are developing first major support?	
Second Major support—clear	a. Minor support b. Minor support Minor supports are developing first major support?	
Third Major support—clear	a. Minor support b. Minor support Minor supports are developing first major support?	
Concluding sentence	Does the concluding sentence restate the topic sentence? Is the author's opinion about the topic emphasized one more time?	
Grammar points		
Works cited		

returned all the drafts were considered. If for any reason the student skipped the drafts, his/her work was discarded. As a result, ten students out of fourteen had their paragraphs included in the research. Each student received a letter to code their work, so Students A through J are the subjects of this case study.

Tables 3 through 5 contain samples of students' writing. There are more from first assignments because after some weeks, students presented the expected structures in their paragraphs, and we started handling different styles of paragraphs such as persuasive, cause and effect, or comparison and contrast.

In the samples presented in Table 3, mainly in students A, B, and F, the theory of digression because

in many cultures writers should not present their points/thesis before some discussion about the topic. However, student I did not have a topic sentence; the student started by the first major support. After receiving the teacher review form, students figured out that a clear and well-developed topic sentence could not only provide their reader clarity towards comprehension, but it would also help them develop a coherent sequence of ideas.

Major-minor supports are presented in Table 4. Most students presented major supports; however, some did not develop them properly by using minor supports. With clear and precise comments, as we can see on Student E's assignment, however, after being given

Table 3
Samples of Topic Sentences

Student and assignment	Second draft	Comments	Third draft
Student A Fourth paragraph assignment	Divorce is the legal dissolution of marriage by agreement between both sides.	It's possible to start with a definition, but the topic sentence should have the three majors included.	Divorce is the legal dissolution of a marriage (Brodereck 253), and in my opinion, there are three main reasons that cause divorce: infidelity, financial problems, and immaturity.
Student B Fourth paragraph assignment	I want to introduce the reasons people travels around the world every day. I have ideas for Economic reasons, political reasons, and Educational reasons.	Your topic sentence should be one sentence containing the major supports of your point.	According to Culver, immigration happens when people leave their country and move to another in order to continue their life; however, there are three main seasons [*sic*] [reasons] that people move to another countries permanently: economic, politic [*sic*], and educational causes.
Student F Third paragraph assignment	The world of careers have [*sic*] many option; what are you interesting in and what will you be good at? What make your become a good chef? A chef is a person who creates food, make food look interesting, and presents the foods to the customers.	The topic sentence is not clear neither the major supports of your point. Also, a topic sentence should be one complete sentence.	The world of careers has many options, and to you [*sic*] choose one profession to follow, we need to figure out if we have characteristics of a good professional has; therefore, to be a good chef, a person need [*sic*] to have passion, be creative, and [be] intelligent.
Student I Second paragraph assignment	My son is a helpful boy because he helps me on my homework; he wash [*sic*] the dishes when I tell him to do it, and he did sometime his self, and he helps me cook dinner or breakfast.	The topic sentence is not clear and there are no majors supporting your point.	My son ___ is the most important person of my life, after my God; he is a wonderful blessing for me, [*sic*] because he is helpful, smart, and respectful for [*sic*] everybody.

Table 4
Samples of Major-Minor

Student and assignment	Second draft	Comments	Third draft
Student E Third paragraph assignment	She is confident to cry with me when I am sad or in troubles [*sic*]; she hides [*sic*] my secrets if I have something important to tell, and when she is with me, I feel safety.	Add a specific example of a situation in which your sister showed all or some these qualities.	Finally, she is empathetic. She cries with me when I am sad or in troubles [*sic*]; she hides my secrets if I have something important to tell, and when she is with me, I feel safety, such as when I was beginning driving, if she was with me I could drive more confident.
Student D Third paragraph assignment	He uses computer a lot; he says that it helps him keeping connected with clients. Also he says with computer, he can quickly diagnose facts and find solution he wants.	Add specific example(s) to develop this major support. Be clear how your friend applies computer to his job and how it helps his clients.	Also, he uses computer a lot because it helps him to keep connected with clients, to research for the best parts and the cheaper [*sic*], so he can also help client [*sic*] spending less money to fix their car, and computer helps him to diagnose fault quickly that helps him to save time.
Student G Second paragraph assignment	Third, he is honest man on his word. people loved him because his honesty, so he became olderman.	Explain what is to become olderman (?). Is this the word? Give examples that develop this major.	Third, he is very honest person, [*sic*] he is always men on his word [a man of one word?]; he does the right things to convince people; he inspired the young age people, so he became olderman, [alderman?] people said to him one day about being olderman of the city, [*sic*] after while he competed himself of the olderman election, and must [most] of the people voted for him, and he won the election.

direction on where to find minors that would support their majors and keep ideas developing, students could develop a better third draft. Another example is Student D, who introduced his major support in a very generic way, and even though the student offers two minor supports, he did not develop the major properly because he is not clarifying how a computer was a useful tool. After comments on the second draft, Student D was able to present minor supports that explained how a computer was a great tool for his friend's work as a mechanic. Also, Student G presented a very wordy third major support with no minor base at all. With a few clear and specific directions, Student G was able to develop his major support by including explanations and examples of how his relative became an important person in his village for being honest. Even though these examples are still with sentence skill issues, small steps removed the rhetorical obstacles.

Students' concluding sentences are presented in Table 5. Students clearly understood that the concluding sentence should reaffirm their point presented in the topic sentence. The adjustments needed at this part of the paragraph were basically to remind them not to just repeat the words and not to add information not presented in the topic sentence. Therefore, the comments on the second draft always hit the necessity of reaffirming the point and reminding the reader of the three major supports.

Table 5
Samples of Concluding Sentences

Student and assignment	Second draft	Comments	Third draft
Student J Third paragraph assignment	In fact it is easy to be Accounting Manager, but it is hard to be a successful.	The topic sentence should be restated in your concluding sentence; include the majors and the proper concluding connector.	In conclusions, [*sic*] it is easy to be an Accounting Manager, but it is had [*sic*] [hard] to be a successful one because
Student C Fifth paragraph assignment	In conclusion, capital punishment does not bring any benefit for the society, so I believe this should be extinct.	The topic sentence and the majors discussed through the paragraph are not restated in the concluding sentence.	In conclusion, capital punishment does not bring any benefit for the society because it does not decrease crime, families are affected by the death of a member, and people should have the chance to change; therefore, I believe that death penalty should be extinct.
Student H Third paragraph assignment	In conclusion, being a teacher would helps me develop my knowledge and my communication, would makes me useful to the world, and would keeps me fresh intellectually.	The three majors expressed in the topic sentence and developed in the paragraph should be restated in the concluding sentence.	In conclusion, a good teacher needs to share his knowledge to influence his students; he needs to develop his communication skills to reach his goals and his students, and he needs to love his job to overcome the chalenges [*sic*] to come.

Analysis of the Interventions

In general, after a certain number of assignments, most students gradually became more and more familiar with the paragraph structure, and consequently, through the semester, the focus on second draft comments gradually changed more to sentence skill issues. At the beginning of the semester, unanimously language trouble was noted as the main reason students had taken that class; however, at the end of the semester, most students understood that academic writing is a process that involves many other aspects besides language skills; it involves cultural aspects that are not adjusted overnight. Therefore, as suggested by Huot (2002) and Fisher et al. (2011), receiving second draft reviews with suggestions that are as clear as possible enabled students to find ways to develop their ideas with examples or explanations in order to produce a coherent paragraph following the English rhetorical model. Also, these interventions turned effective the proposal of Fisher et al. (2011) of "creating a meaningful and challenging task in which students are engaged in work that has personal relevance or real world application" (p. 135). Most of the students aimed to attend college and pursue a degree; they realized they needed to accommodate their knowledge to succeed.

Finally, some of these students did not enjoy writing at all, but Freire (2003) noted, "Liberation is a *praxis*: the action and reflection of men and women upon their world in order to transform it" (p. 79). In other words, Freire (2003) meant that practicing brings liberation because it makes people reflect first on what and where the obstacle is and then on how to act to overcome it. These students had a very particular way to see academic English, and it was based on their previous concept from years of study in their own languages. After being introduced to a new reality, the writing process adopted in this class collaborated with their own transformation. Obviously, this particular Intermediate Writing class did not intend to solve all students' writing problems, and not all students were able to adjust successfully; however, this class started these students' journey towards improvement.

Conclusion

In conclusion, simply changing the order in which the paragraph structure and terminology were presented to our ESL students was very beneficial to this class

since students had the visual aspect of that by comparing their own paragraph to the model proposed. They built a new knowledge on top of the one they already had. I prefer to say they adjusted their concepts of properly written material and applied the new concepts to the entire class.

Also, besides being strict about the grammar aspects, the second draft response also provided students clear orientation towards the writing quality they were expected to develop during the semester. Obviously, taking a student's second draft and reviewing it beyond the editing level demands more time and effort from teachers, but the results are worthy not only because of the effects on students' grades, but also because "empowering education is oriented to self-transformation" (Shor, 1992, p. 188), so it increased students' confidence; the majority of the students apply their learning not only to other classes they are taking, but also to their daily life activities, such as their jobs. During the semester, comments from students demonstrate that they had become critical not only about their own writing but also about native speakers'. Students came to class and talked freely about their confidence in writing e-mails and taking more challenging writing activities at work because they felt able to manage them. Several students talked about the compliments they got from co-workers or even bosses about their writing improvement. This, I truly believe, is to empower our students by making a very simple change because

> we make ourselves in the world according to the way we have learned to think about society and our place in it. On the other hand, human thought, language, and action are never fully under singular control, never monolithically determined by a status quo. (Shor, 1999, "Working Through the Writing Class," para. 1)

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Acknowledgments

"The Course Fit Us": Differentiated Instruction in the College Classroom

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As diversity in higher education increases, the one-size-fits-all, teacher-centered, traditional model of lecture-style teaching sets students up for failure. In addition, the strategic rhetoric of blaming students for academic failures keeps the systemic power in place, justifying the current system. In contrast, differentiated instruction, a student-centered instructional model, has shown success in higher education through a limited number of mostly qualitative studies. The purpose of the current study was to explore implementing differentiated instruction in higher education to understand if quantitative improvements were noted in a differentiated (DI) classroom compared to a nondifferentiated (NDI) classroom in two different sections of the same Educational Psychology course taught by the same instructor. In addition, perceptions toward the use of differentiated instruction were attained. The DI and NDI sections had enrollments of 39 and 38 undergraduate students, respectively. The majority were preservice teachers attending a mid-sized Midwestern University. The DI group significantly outperformed the NDI group on the aggregates of the assignments and the exams. However, only two assignments and one exam showed significantly higher scores for the DI group when examined individually. The DI group perceived differentiated methods as beneficial to their learning as noted on the course evaluation and survey questions.

At the higher education level, students are perhaps even more diverse than K-12 students due to their varied educational and life experiences, yet less consideration for diversity in instructional planning occurs (Merriam, Caffarella, & Baumgartner, 2007). Planning instruction to meet the needs of the adult population, however, becomes no less imperative considering the changing demographics of this population and the increasing numbers of adult learners today (Aud et al., 2011; Merriam et al., 2007; Santangelo & Tomlinson, 2009; Wormeli, 2007). Pliner and Johnson (2004) elaborated, "higher education in the United States has been primarily available to a professional class that was white, able-bodied, heterosexual, Christian, and male" (p. 106). In recent years, higher education has become more inclusive; however, the curriculum and teaching methods have not been altered sufficiently in response to incorporating diverse students and meeting their unique educational aspirations. The one-size-fits-all, traditional model of lecture-style teaching and teacher-driven education continues to dominate in college

With increasingly diverse adult learners and few alterations to higher education teaching methods, undergraduate institutions have found that the number of students repeating college courses is disturbing. Aud et al. (2011), in a report on remediation, uncovered the following:

> In 2007-2008, approximately 36 percent of first-year undergraduate students reported that they had ever taken a remedial course, and 20 percent of first-year undergraduates reported that they had taken at least one remedial course in the 2007-08 academic year. (p. 70)

This academic failure is pervasive for students of all racial groups, genders and types of disabilities (Aud et al., 2011).

Failing Methods for Adult Learners

The high percentage of students repeating an academic course indicates a mismatch between college instruction and students' academic needs. In addition the current educational system works hard to keep the traditional ideals and "one-size-fits-all" methods in place rather than employing more learner-centered approaches. For example, Fassett and Warren (2004) found when interviewing teachers and students that both use strategic rhetoric and behaviors which keep systemic power in place so that the current educational system can be justified.

The three types of rhetoric that Fasset and Warren (2004) stated are most often used are individualism, victimization, and authenticity. Individualism is the notion that the student's success is based solely on one's efforts, but without consideration for the many contextual factors such as the unspoken educational expectations, culture, and socioeconomics. In other words, there is nothing wrong with the system or the current hegemonic ideal; if the student cannot make it in the current system, then it is his (gender will be alternated throughout) own fault. Blame can stem from the student himself or the teacher.

Victimization, in direct opposition to the individualism strategic rhetoric, holds that the student is a victim of the context, namely societal rules, teacher expectations or institutional rules Within the rhetoric of victimization, any form of control over success or failure is unavailable to the student. The student simply needs to survive the current system because there is no hope for change in the institution.

The strategy of authenticity falls under three forms of power: "(1) a failure to measure up to standards, (2) mythical other's success, and (3) popular culture as a

model" (Fassett & Warren, 2004, p. 33). Again, the student is blamed for not meeting deadlines or other societal norms of education. Second, the student is compared to others such as peers or the teacher herself; these superior (hegemonic) measures are then used to judge the student. Third, expectations of the classroom in the movies or other media are used as gauges for how teachers and the educational experience should be. Students are said to expect, for example, that all teachers should be like the inspirational ones seen in specific films, an unrealistic goal because movies are made for entertainment and fail to capture the day-to-day demands of a classroom.

Blaming the student for not learning connects to the traditional model, or teacher-centered model of education. In other words, the teacher decides what students learn as he is the keeper of the knowledge, which oftentimes is distributed in a lecture format. If students do not learn the material, it is their fault. In sharp contrast to these three rhetorical frames that admonish the student for learning failure, differentiated instruction is student-centered.

Differentiated Instruction

Differentiated instruction is a teacher mindset that all learners respond to instruction differently. Therefore, a one-size-fits- all mentality limits student opportunity to benefit from the instructional method applied. Teachers who utilize differentiated instruction take into consideration multiple aspects of learners to best meet their educational needs. Three diagnostic formative components are utilized to best understand personal characteristics of students and their academic skills: readiness, interest, and learning profile (Tomlinson, 2001).

Student readiness refers to a student's proximity to the desired educational outcome based on background foundational knowledge, past experiences, opportunities for learning, and skill level. Readiness means the student is always kept in his zone of proximal development, a position where, with guidance, the student can successfully learn new material (Vygotsky, 1997).

When students are interested, intrinsic motivation is awakened (Deci & Ryan, 1985; Vansteenkiste, Lens, & Deci, 2006). Thus, tapping into students' interests through differentiated instruction is significant. To maintain intrinsic motivation, Jensen (2005) suggested allowing students choices, activating their background knowledge, increasing feedback, and providing a safe environment for exploring.

Finally, a student's learning profile is defined as "a preference for taking in, exploring, or expressing content" (Tomlinson & Imbeau, 2010, p. 17). A learning profile consists of a student's preferred contextual environment, intelligences, gender, and culture (Tomlinson & Imbeau, 2010). Each of these preferences contributes to how a student learns most proficiently and efficiently. Contextual environment pertains to ways of learning such as alone or in a group and to issues such as how information is presented. Intelligences refer to different ways students think such as practically, analytically or creatively (Sternberg & Spear-Swerling, 1996) or through multiple intelligences as suggested by Gardner (1993). One's gender also affects learning for a variety of reasons including social, cultural and physiological differences (Jensen, 2005). Finally, one's culture can distinguish what information is considered worth learning (Vygotsky, 1978).

After understanding how students best learn, the teacher can differentiate any or all of the following: content, process, product and affect. To differentiate content, one might use three texts about the Holocaust at three different reading levels that match the students' varying needs.

Process entails how the student makes sense of the information and learns. Tomlinson and Allan (2000) used "activity" as a synonym to define *process*. For example, when working with a student who enjoys critiquing movies, a teacher might encourage the student to learn about the Industrial Revolution through analyzing and evaluating film documentaries of that era.

Product refers to a medium through which the students show what they know, understand and are able to do, based on their investigation of a specific topic. An example of product differentiation would be a teacher allowing students to express their knowledge of a topic through a variety of choices such as writing a newspaper article, creating a skit or drawing a cartoon.

Finally, affect addresses students' emotions about school-related issues that influence their learning. "Student affect is the gateway to helping each student become more fully engaged and successful in learning" (Tomlinson, 2008). Affect is embedded within the content, process and product; therefore, many studies regarding differentiated instruction do not mention affect with the other three diagnostic components.

Differentiated Studies and Academic Performance

Differentiated instruction has been applied in grades K-12 with positive academic gains. At the elementary level, significant academic growth was noted among diverse students in language arts (Beecher & Sweeny, 2008; Cusumano & Muelier, 2007) and math (Beecher & Sweeny, 2008; Grimes & Stevens, 2009; Tomlinson, 2009). These gains were documented for students of all ability levels, across all racial groups, for English language learners, and for students of all socioeconomic levels. In addition, Avci, Yüksel, Soyer, and Balıkçioğlu (2009) and Grimes and Stevens (2009)

also noted affective gains among students involved in their research.

At middle schools and high schools, differentiated instruction implementation occurs less frequently than in elementary schools. Consequently, few research studies focused on differentiated instruction at these levels have been documented. However, significant academic improvements were found for students when differentiated instructional methods were utilized compared to students where teachers used traditional methods of instruction in science (Mastropieri et al., 2006) and in biology and literature (Graham, 2009). Tomlinson (2009) stated that significant gains were found for standardized test scores in math, reading, and writing for Colchester High School in New York within 5 years of beginning a system-wide differentiation initiative. Tomlinson also noted a decrease in behavior referrals.

At the college level, even fewer studies exist regarding differentiation, possibly for several reasons including the following: (a) class sizes are typically quite large; (b) the number of contact hours with students is minimal; (c) designing several ways to assess students is time consuming and challenging for professors who, in addition to teaching, have research and service obligations; and, finally, (d) ethical issues such as fairness in grading can be controversial (Ernst & Ernst, 2005). Although scarce, the following few examples provide brief summaries of extant qualitative research studies on differentiation in higher education.

Ernst and Ernst (2005) conducted research in an undergraduate political science course where differentiated instruction was utilized. Their study employed a Likert-type survey regarding perceptions of differentiated instruction and their written perspectives acquired through open-ended questions. The majority of the 35 students in the course affirmed that the course helped them reach their learning potential, group work benefitted their learning, and they appreciated having choices and exploring topics based on their interests.

In another qualitative study, Livingston (2006) found success utilizing differentiated instruction in his undergraduate education course wherein 33 preservice teachers learned how to teach using constructivist methods. The students wrote reflections and responded to a variety of questions throughout the course that were collected by the instructor. Unanimously, the students stated that they appreciated being able to choose how to complete their assignments according to their own learning styles and felt that choice allowed them to better learn the information. The teacher as a facilitator, rather than a lecturer, was also highly approved by students.

Santangelo and Tomlinson (2009) conducted a qualitative investigation of 25 diverse graduate students enrolled in Santangelo's Education and Psychology of

Exceptional Learners course. Santangelo and Tomlinson (2009) designed and administered a pre-assessment, rubrics for five key course assignments, and classroom activities to measure student mastery of the material. They stated that all students met the course objectives; however, they did not provide a clear picture of how mastery was measured. On the course evaluation, students indicated the following benefits: (a) using a variety of materials and activities, (b) participating in collaborative learning opportunities, (c) having options for expressing their knowledge, (d) learning strategies that were designed to support text comprehension, and (e) having the provision of choices (Santangelo & Tomlinson, 2009).

One study used a quasi-experimental design. Chamberlin and Powers (2010) had three instructors teach a first-year college math course for preservice teachers using similar differentiated instructional methods. Meanwhile, four different instructors, using traditional methods, taught the other five sections that constituted the control group. Homework, writing prompts, projects, quizzes and tests were used to assess understanding, with all students completing the same quizzes and tests. Chamberlin and Powers (2010) assessed student progress in reference to meeting course objectives and constructed a survey to measure elements of differentiated instruction, which was completed by students in both groups. They also conducted interviews to ascertain if there were any differences in perception between the two groups. The results indicated the experimental group made higher gains. On average, the treatment group participants scored 1.7 items higher on math scores from pretest to posttest compared to an average gain of .3 items scored higher for the control group. The results revealed that the students successfully met the course objectives and that the participants in the experimental sections perceived the course more positively due to the differentiated methods of instruction (Chamberlin & Powers, 2010).

Tulbure (2011) conducted an experimental investigation in her Educational Science classes using Kolb's learning styles categories to place pre-service teachers in small sub-groups and differentiated instruction accordingly. The control group was taught as a whole class without differentiation. Significant differences were found on pre and post-test achievement scores within subjects for the experimental group, but not for the control group; however, no significant differences were found between experimental and control groups on achievement scores (Tulbure, 2011). The experimental group did improve more in achievement scores than the control group, but not significantly (Tulbure, 2011).

With so little research on differentiated instruction at the higher educational level, further studies are

needed to gauge the impact of this educational approach on college students' academic success. The purpose of this study was to explore implementing differentiated methods in higher education to investigate whether quantitative improvements are noted in a differentiated (DI) classroom compared to a nondifferentiated (NDI) classroom in two different sections of the same course taught by the same instructor. In addition, we were curious as to whether the DI students would perceive differentiated methods as beneficial to their learning.

Methods

The participants in the study were undergraduate students in a Midwestern university (enrollment 7,000 + students) who were registered in two sections of Educational Psychology; the lead author was the instructor for each section. The course was a liberal arts elective at the university but also a required course for early childhood-, elementary-, and secondary-level preservice teachers. The course includes psychological theory and research related to learning, motivation, cooperation, and instruction within diverse cultures and settings. The two sections of the course I taught were held back-to-back in the same classroom on Tuesday and Thursday afternoons with each session lasting 75 minutes. In preparing to teach the two sections of Educational Psychology differently, we chose the earlier (1:30 p.m.) section as the NDI group (nondifferentiated instructional group) and the latter (3:00 p.m.) section as the DI group (differentiated instructional group). The traditional lecture-style teaching for the NDI group made sense to do before attempting the differentiated teaching, as we wanted to avoid accidently carrying the differentiated methods into the NDI course. All students who registered for the 1:30 p.m. section became part of the control group whereas all students who registered for the 3:00 p.m. section became part of the experimental group.

Participants

Control group. The control or nondifferentiated instructional (NDI) group consisted of 38 undergraduate students. Of the 27 females and 11 males enrolled in the course, 37 were Caucasian and one was of Middle Eastern descent. Their ages ranged from 18 to 30 with the majority between 18 and 20 years of age. Most of the students (89%) were preservice teachers (early childhood education, elementary education, secondary education, and special education) while 11% were other majors (mortuary science, graphic design, psychology, and military science).

Experimental group. The experimental or DI group consisted of 39 undergraduate, Caucasian students. Among the 32 females and 7 males enrolled in the course, the age span of the students ranged from 18 to 49 years of age with the majority (69.2%) between 18 and 20 years. The majority of the students (85%) were preservice teachers while the other 15% majored in paralegal studies or psychology, with three students undeclared. Over half the DI students were in their first or second years of college; however, four students in the group had previous undergraduate degrees. For a comparison between the experimental group's and the control group's demographic information, see Table 1.

Course Design for Both Groups

All students were informed that their academic grades would be used as part of a study examining differentiated teaching methods; however, all identifying information would remain confidential. To ensure anonymity, notecards were distributed to the DI

Table 1
Demographics of Participants in the DI and NDI Groups

		DI (n = 38)		NDI (n = 39)	
		N	%	N	%
Students	Male	7	18	11	29
	Female	32	82	27	71
Ethnicity	White	39	100	37	97
	Mid. Eastern	0	0	1	3
Age in years	18-20	27	69.2	26	68.4
	21-25	6	15.4	9	23.7
	26-30	2	5.1	2	5.3
	31+	4	10.3	1	2.6
Major	Education	33	85	34	89
	Non-Education	6	15	4	11
Previous degrees		4	10	0	0

group and the NDI group on the first day of class. Students wrote their first and last names on one side of the card, drew a number between one and 85, and then wrote that number on the other side. The numbers allowed for scoring of assignments and exams with the intent of minimizing bias. Students were asked to turn in assignments and exams using a version of this format: their number, the course, and the assignment number (e.g., #34, Ed Psych 294, Assignment 4). Only after scoring assignments did I match numbers with names and enter their points into the gradebook. Although the choice of the assignment product may have differed, the requirements for the assignments remained the same for all students. For further assurance, one colleague not associated with the study scored a random sample (25%) of Assignment 4 and another colleague scored a random sample (25%) of the Exam 2 essay questions to establish inter-rater reliability of the rubrics.

Instructional Design

All students were held to the same course objectives and the same grading criteria in both sections. The NDI group was taught in a teacher-centered, traditional lecture format with students taking notes and did not have choices in how to complete assignments; all were written assignments.

The DI group was taught using a constructivist, student-centered format with many hands-on activities, choices for completing assignments, and instruction altered based on formative assessments. For example, after we covered a unit on Piaget's stages of cognitive development, a few students were still struggling with the concept of conservation (understanding that a quantity can remain the same even if its appearance changes, e.g. a ball of play dough versus a cube of play dough) according to the exit cards; thus, the instructor asked a colleague if her preschool-aged son could join us for class. We demonstrated a conservation task with the preschooler. Afterwards, the students all gave thumbs up that they understood the concept.

Assessments

Formative assessments. For both groups, the instructor taught a lesson on Gardner's Multiple Intelligence theory and Sternberg's Triarchic theories. Both groups participated in an application of these theories by completing an instructor-created learning profile inventory, Gardner's Multiple Intelligence Survey, and Sternberg's Survey. Although the learning profile inventory and the two intelligence surveys were given to both sections, these instruments are typically used as a differentiated instructional technique. Therefore, the data for the NDI group was not analyzed or utilized to plan for their instructional needs. The

following examples pertain to formative assessments and how they were utilized for instruction only with regard to the DI group.

The learning profile contained questions and statements regarding (a) demographic information, (b) past school experience, (c) preferred ways of learning, (d) preferred contextual environments, and (d) interests. Through examining, studying, and frequent referencing of my students' learning profiles and the intelligence surveys, I discovered many interests and preferences of my DI students that I incorporated into my instruction. For example, one of my students was a baseball enthusiast, so when trying to explain intrinsic and extrinsic motivation, I began by asking the student whether he thought that professional baseball players played the sport because of intrinsic (love of the game) or extrinsic (big money) motivations.

Students completed Sternberg's survey and discovered their preferences for representing knowledge: creatively, practically or analytically. Using these results, the instructor divided the DI students into groups accordingly. Then, each group was given a choice board that included three activities to choose from within their preferred way to demonstrate their knowledge on the subject of "creating classroom rules."

Numerous other formative assessments were used on a daily basis to check for student understanding and to alter instruction, including (a) thumbs up/thumbs down, (b) question and answer sessions, (c) reviews, (d) cold calling, (e) quick writes, (f) exit cards, (g) review of notes, (h) observation of activities completed, and (i) small group performance tasks. The formative assessments were teacher-made for the DI group and were used to guide my instruction for the DI section. Also to assist with future instructional planning, the instructor kept a journal, though sometimes sporadically, throughout the course.

Summative assessments. Summative assessments—seven assignments and three exams—were used to verify student learning and for grades. Rubrics for the assignments and for scoring essay questions on the exams were also teacher-made. The rubrics held the same requirements and scoring for all students. The assignments for the DI group allowed for choices that I surmised would be appealing to the students. The seven assignments were essentially the same for the DI group and the NDI group, with the exception of product choice. The exams consisted of multiple choice, true/false and short essay questions for all students. Each exam was worth 50 points. Students in both groups were required by forced choice to eliminate five multiple choice questions on each exam. As an instructor, I know that I do not create perfect tests and every test has error within it; the purpose was to give both groups choices to eliminate test items that created uncertainty and to ease test anxiety (differentiation according to affect).

Class Evaluation

Finally, an evaluation created by the instructor was used to solicit feedback regarding the course at the end of the semester. The evaluation consisted of a 10-item survey, which invited students to rate statements using a 6-point Likert-type scale. Participants rated statements from *strongly disagree* to *strongly agree*. In addition, students were asked to respond to four open-ended questions. Specifically, I wanted to see if the DI group found the instructional methods more beneficial than the NDI group.

Results

We utilized SPSS to conduct all analyses of quantitative data. To ensure that the DI group's internal variance of mean scores was not significantly different from the NDI group's internal variance of mean scores, a Levene's test for equality of variances (Levene, 1960) was conducted. Using a 95% confidence interval, no significant variance was found between the groups for the exams ($p = .157$) or the assignments ($p = .935$); therefore, equal variances were assumed.

An independent-samples t test was used to compare the two different sample populations (DI and NDI) that completed the same tasks (assignments and exams). The t test compared the difference in mean scores of the DI and NDI groups on six of the assignments and all three exams. Assignment 5 was not included in the analysis because the assignment erroneously was not differentiated for the DI group. As shown in Table 2, the aggregate mean score for the DI group ($M = 18.96$) was significantly higher than the mean score for the NDI group ($M = 18.46$) on the seven assignments, $t(75) = 2.128$, $p < .05$. Also, the aggregate mean score for the DI group ($M = 39.77$) was significantly higher than the mean score for the NDI group ($M = 37.35$) on the three exams, $t(75) = 1.995$, $p < .05$.

Table 3 shows the comparative mean scores for each of the seven assignments and for the three exam using an ANOVA. All assignments were worth 20 points and all exams were 50 points. Appendices A and B are the assignment instructions that were given to the DI and NDI groups explaining what each assignment entailed for each group.

Inter-rater reliability was calculated for the rubrics used to score student assignments and exam essay questions using Pearson's pairwise correlation. The inter-rater reliability coefficient between scorers on Assignment 4 was $r = .95$ and on Exam 2 was $r = 1.00$, which are both considered highly sufficient (Salvia, Ysseldyke, & Bolt, 2007). Inter-rater reliability was not conducted on the other assignments and exams.

In summary, using an independent-samples t test, significant differences were found between the aggregate mean group scores on the six assignments and the three exams (see Table 2). However, individually, only two of the assignments and one of the exams showed significant differences for the DI group (see Table 3).

End of Course Evaluation

The reliability of the current survey had a Cronbach's alpha of .885 across the nine items. Students rated each of the nine statements using a 6-point Likert-type scale from *strongly disagree* to *strongly agree*. In the NDI group, 32 of 38 (84.2%) students completed the optional survey while 34 of 39 (87.2%) students of the DI group did. No students from either group rated any of the items at the *strongly disagree* or *disagree* level. Ten students in the NDI group and only one in the DI group placed a rating at the *slightly disagree* level. Over 90% of the students in both groups rated each statement with some form of agreement (*slightly agree*, *agree*, and *strongly agree*); however, the ratings between the NDI and DI groups did differ in the intensity of ratings with the DI group giving stronger ratings on all of the statements. Table 4 represents the number of students who indicated disagreement or agreement for each statement.

The course evaluation also included five open-ended questions. Two of the questions were logistical regarding course suggestions and class attendance. The next three questions were particularly relevant to this study. The first question was, "What did you like MOST about this course? Explain." The second open-ended question was, "How was this course different from other courses you have taken? Explain." The third aspect asked for "Additional comments."

Table 2

Aggregated Mean Score Differences Between Groups on Assignments and Exams

Measure	Group	N	M	SD	p
Assignments	DI	39	18.96	.99	.037*
	NDI	38	18.46	1.07	
Exams	DI	39	39.77	4.76	.050*
	NDI	38	37.35	5.84	

Note. Assignment 5 was not included in the calculations due to failure on the part of the instructor to differentiate the task for the DI group. Because the calculation landed exactly on .050 for exams, the significance seems likely.
* $p < .05$.

Table 3
Between Group Score Differences for Each Assignment and Exam

Measure	Group	N	M	SD	p
Assignment 1	DI	37	18.95	1.68	.437
	NDI	35	18.60	2.06	
Assignment 2	DI	38	19.26	.98	.001*
	NDI	38	18.18	1.74	
Assignment 3	DI	37	19.16	1.28	.000*
	NDI	36	17.89	1.33	
Assignment 4	DI	39	18.38	2.20	.518
	NDI	35	18.69	1.73	
Assignment 5	DI	38	19.21	1.14	.001*
	NDI	38	19.87	.41	
Assignment 6	DI	37	18.95	1.58	.549
	NDI	36	18.72	1.60	
Assignment 7	DI	39	19.08	1.60	.779
	NDI	37	18.97	1.62	
Exam 1	DI	39	40.10	5.41	.141
	NDI	38	38.18	5.90	
Exam 2	DI	39	39.59	6.06	.022*
	NDI	38	35.89	7.77	
Exam 3	DI	39	39.62	5.29	.201
	NDI	38	37.97	5.87	

Note. Assignment 5 was the same for both groups; however, it was not included in the aggregate mean score calculation for assignments due to failure to differentiate for the DI group. Mean differences between groups are significant at α = .05.
* *p* < .05.

Table 4
Number of Students Indicating Disagreement and Agreement for Instructor End of Course Evaluations

		Slightly disagree	Slightly agree	Agree	Strongly agree
The instructor was knowledgeable regarding the course material.	NDI	--	--	10	22
	DI	--	--	4	30
The instructor demonstrated respect for individual differences.	NDI	--	--	6	26
	DI	--	--	5	29
The instructor stimulated my interest in the course.	NDI	--	4	10	18
	DI	--	1	2	31
The instructor taught me information in ways that allowed me to understand the material.	NDI	3	6	12	11
	DI	--	2	5	27
I would recommend this instructor to my friends.	NDI	1	2	6	23
	DI	--	1	2	31
The general climate in this course was good for learning.	NDI	1	3	8	20
	DI	--	--	6	28
The course respected diverse ways of learning.	NDI	2	2	6	22
	DI	--	--	4	30
The assignments engaged me in learning.	NDI	2	5	10	15
	DI	--	1	9	24
Overall, I learned a great deal from this course.	NDI	1	2	10	19
	DI	--	1	4	29

Note. NDI *n* = 32; DI *n* = 34.

A great variety of answers were given for these questions with several similarities between the two groups. Four overarching themes surfaced from the two groups: Environment, Instruction, Curriculum, and Teacher Qualities. We categorized comments under Environment if students' statements described or related to the feel of the room or the actual physical set up. Instruction included comments about instructional delivery or the process of learning. Curriculum included comments pertaining to the text, supplemental materials, assignments, and exams. Teacher Qualities included direct comments about personal qualities of the teacher. The categories are not perfectly isolated from one another. For example, classroom activities could be categorized under Instruction as a way of learning or under Curriculum as an activity model. Similar and dissimilar comments from each group are listed in Table 5.

The open-ended questions on the evaluation showed that both groups had similar comments regarding the course's Environment and the Teacher Qualities; however, differences were shown regarding Instruction and Curriculum. Particularly, students in the DI group appreciated choice, more freedoms and consideration of their learning styles.

Findings Regarding Research Questions

The answer to the first research question is that differentiated instructional methods for the DI group showed some significant achievement in students' academic learning compared to the NDI group. Assignments 2 and 3 were significantly higher for the DI group. On Assignments 1, 6, and 7, the DI group scored slightly higher than the NDI group, but not significantly. On Assignment 4, the NDI group actually scored slightly higher than the DI group, but not to a significant level. The inconsistency of the score differences on the assignments may have been due to the fact that the assignments were created before the class commenced. At that time we had no reference for knowing the DI students' interests. Maybe the assignments that showed significantly higher scores for the DI students contained options that better fit their learning profile.

Interestingly, the NDI group scored significantly higher than the DI group on Assignment 5. When creating this assignment, the instructor made an error by not providing choices for Assignment 5 for the DI group. Both groups received the identical instructions stating only one way for the students to demonstrate their learning. The autonomy and feeling of self-control that choice provided was nonexistent and may be why the DI group performed significantly lower on this assignment. If choice truly does have this strong of an impact (Jang, Reeve, & Deci, 2010; Santangelo & Tomlinson, 2010; Vansteenkiste et al., 2006), then the

philosophy of differentiated instruction becomes even more imperative to meet the needs of college students.

The overall exam score composite which included three exams was also significantly higher for the DI group than for the NDI group. Not only on the overall composite but also on each of the three exams, the mean for the DI group was higher than the mean for the NDI group. However, only on Exam 2 were the scores for the DI group significantly higher than the NDI group. The content of the exams was identical for both groups.

Regarding the second research question of whether the DI students would perceive differentiated methods as beneficial to their learning, the answer is yes. The instructor-authored course evaluation conveyed that the majority—over 90% of the students—rated the items with some form of agreement, but the highest ratings came from the DI group. On the open-ended questions ("What do you like most about this course?"; "How was this course different from other courses you have taken?"; and the "Additional comments" section), students gave very similar comments about the Instructor. This made sense, as the instructor was the same in both classrooms. The comments on the Environment were also similar, as the same physical classroom was utilized and the feel of the environment was similar. As noted by the comments from both sections, the students felt comfortable to share, relaxed, and liked that the teacher knew them by name. Where differences occurred between the groups was with Instruction and Curriculum. The majority of the NDI students made typical comments about liking or disliking (a) the curriculum, (b) the assignments, (c) in-class activities, (d) discussions, and (e) video clips. However, the DI students made comments about (a) freedom of choice, (b) their strong sense of engagement and interest, (c) the fact that their learning styles were considered, (d) doing self-evaluations, (e) learning to a deeper level, (f) instruction that helped them understand, and (g) the course being "fit" to them. The DI students referenced the components of differentiated instruction: learning profiles, readiness, and interest. The DI students did perceive differentiated methods to be beneficial to their overall learning; the ratings were stronger for the DI group than those of the NDI group on all nine evaluation statements.

The students in the DI group, again, showed support for choice. At the college level, this also held true in the findings of Ernst and Ernst (2005), Livingston (2006), and Santangelo and Tomlinson (2010). The students in each of these studies shared that they appreciated having choices and they felt it improved their learning of the material.

Discussion and Recommendations

Choice in product appears to have had a strong impact on aggregate score differences between DI an NDI groups. However, pinpointing one component of

Table 5
Similar and Dissimilar Comments Between the NDI and DI Groups on the Two End of
Course Evaluation Questions and Additional Comments Section

Questions	Comments

Similar

Considering the Environment, both groups indicated the following:
  1. Students liked the classroom dynamics.
  2. Students felt safe to share in a nonjudgmental classroom.
  3. Students felt that their opinions mattered.
  4. Students liked that the course was laid back, relaxing, and stress-free.
  5. Students enjoyed/didn't mind coming to class.

With regard to the Instruction, both groups conveyed these ideas:
  1. Students stated that the instruction was exciting, engaging, fun, and interesting.
  2. Students found that the topics were related to real life making content more understandable.
  3. Students liked the discussions and group work.
  4. Students appreciated that the instructor provided many examples.
  5. Students liked the varied ways of teaching the instructor used—not just lecture.
  6. Students liked applying the things they learned.
  7. Students felt that they learned a lot.

Concerning the Curriculum, both groups highlighted the following:
  1. Students liked learning the material in this course.
  2. Students liked the assignments and the options on the tests.
  3. Students liked the study guide outlines for exams.
  4. Students liked the in-class activities.
  5. Students liked the video clips used in class.

Pertaining to Teacher Qualities:
  1. Students felt that teacher was caring and understanding.
  2. Students appreciated the passion that the teacher displayed about the topics.
  3. Students felt that the teacher was helpful.
  4. Students stated that the teacher was knowledgeable about the subject matter.

Dissimilar

Unique to the NDI group:
  Environment:
  1. One student stated that he liked the chairs in the room because they allowed him to move around a bit (the chairs were on wheels and could recline slightly).
  Teacher:
  1. Another student commented the teacher was fair in her practices.

Unique to the DI group:
  Instruction:
  1. Students stated that they learned material to a deeper level.
  2. Students stated that the course was well-organized.
  3. Students felt that the course was "a fit" for them.
  4. Students noticed that the teacher taught for different learning styles.
  Curriculum:
  1. Students appreciated the meaningful assignments.
  2. Students liked that the assignments were differentiated.
  3. Student valued having choices when completing their assignments.
  4. Student liked doing self-reviews.

differentiated instruction that enabled this to occur for the students' comprehensive learning as measured by the exams, which were identical must refer to something more specific for just the DI group.

The overall content was the same for both sections but the difference was that the instructor knew the DI students more holistically. The assessments and continuous reflection on her teaching allowed for this difference. As Wormeli (2007) explained,

"Differentiation is foremost a professional and responsive mind-set" (p. 7). We agree. Through ongoing formative and summative assessments plus continuous reflection, the instructor came to know the DI students on many fronts.

Philosophically, differentiated instruction is a student-centered and holistic approach. Students in both sections commented on the relaxed environment, engaging instruction, interesting material, and a caring teacher as beneficial to their learning. However, the DI class went further. For example, several students stated, "She considered how we learned and took time out to make the course fit us [*sic*]"; "She included different activities and learning styles for all students"; and, "We actually got self reviews every once in a while to see how we were doing."

The exam scores, as well as the qualitative comments, supported that students learned at a deeper level. Logically, this makes sense in that their mastery of the material was ensured through the use of continuous assessment of their learning, which guided further instruction.

This differentiated philosophy—or mindset—of teaching, the cycle of purposefully using ongoing assessments to guide the next steps in instruction that ensure learning, is what we believe accounts for the significant difference on the overall exam scores between the DI group and the NDI group.

Implications

Differentiation could be the difference between academic success and failure for many students. A professional mindset of differentiation includes a learner-centered, constructivist model that will meet the needs of all learners at every level. Differentiated instruction may significantly alter the current remedial issues for college students and hopefully will lessen the impact of strategic rhetoric (Fassett & Warren, 2004).

It is imperative that educators recognize our responsibility to ensure that all of our students have the opportunity to learn the course material and can access the curriculum via instruction that matches their learning needs. Educators and students alike share this responsibility of students' learning. Both have an obligation to eliminate the rhetorical framework or blaming game that does not benefit the student or the educator.

As an instructor of preservice teachers, another implication is that differentiated instruction must be incorporated in training programs for our future teachers. Within the INTASC standards for teacher education, preservice teachers must know about and be able to implement differentiation. Therefore, preservice teachers need to observe differentiation in action during their teacher training and then practice differentiated

instruction during their practica and student teaching (Darling-Hammond, Hammerness, Grossman, Rust, & Shulman, 2005; Goodnough, 2009). Preservice teachers must be knowledgeable and experienced in conducting formative and summative assessments as these are the driving force behind differentiated instruction. Without assessment, it is virtually impossible to differentiate effectively.

Differentiation is challenging at all levels, but perhaps more so at the college level. Initially, more planning time and reflection are needed to differentiate to meet the diverse needs of students. Regardless of the discipline, small steps are preferable over trying to adopt a full-scale DI approach. It is critical to understand that DI does not mean that "anything goes." A higher education course should be guided and shaped by common goals, objectives, and evaluation criteria. With these established, the instructor has the foundation to plan for differentiation. Some examples, not in any particularly rank order, include (a) pre-assessment of background knowledge (entrance slips), (b) learning profiles, (c) awareness of expert blind spots (Wiggins & McTighe, 2006), (d) exit slips to ensure understanding, and (e) bound choices based on identical expectations as delineated in a rubric (see Appendix B).

In addition, educators in higher education can audit reoccurring stumbling blocks within courses allowing for preplanning of how to approach difficult material. Over the years, we have realized that college students tend to stumble on the same concepts or understandings as the students in previous semesters and differentiated materials used in previous semesters can again be utilized to help clarify. Tomlinson (2008) stated that it takes several years to differentiate well and our journey with differentiation has only just begun. A differentiated mind-set occurs gradually as does the development of methods and materials to support this philosophy. The key is to start small and build on one's repertoire of materials and methods for differentiation. Recognizing that this is a short list of possibilities, some excellent references for further strategies include Cross and Angelo (1993), Tomlinson and Imbeau (2010), and Huba and Freed (2000).

Just as students are whole people, we posit that differentiation must occur as a whole package. As the comments of these students confirmed, differentiation must consider (a) readiness levels, (b) interests, (c) learning profiles, (d) the affect regarding the teacher, (e) the course material, and (f) the environment. Each component is integral.

Limitations

The lead author has been using differentiated instruction for years, but more extensively in this study than in previous courses taught. However, reflection

surfaces missed opportunities to differentiate that may have allowed for even stronger connections to the material and even deeper learning for the students. The score differences may seem minimal but with a teacher who has more experience with differentiation, we believe that an even larger difference would be obtained.

Another limitation to this study was that inter-rater reliability was only conducted on one assignment and one exam. Reliability measures on all of the assignments and exams would be preferable.

The possibility that students from the DI section of the course interacted with students from the NDI section could also have potentially skewed the assessment data. For example, had the students come together from the DI and NDI classes to study, the DI student could have shared more depth of information about a topic. The responses on the end of course evaluation may also have been influenced based on possible interaction of the two groups.

Future Research Recommendations

Further quantitative research needs to be conducted at the college level to better understand the impact of differentiated instruction for diverse learners. Tulbure's (2011) study ending in mixed results confirms that more studies in this area need to be conducted. This study refers to an undergraduate Educational Psychology course that only and needs to be replicated to confirm the findings.

Another research issue is whether differentiated instruction can be implemented across all disciplines or only for certain lower level courses. In other words, would differentiated instruction be beneficial for courses in more specialized courses, such as in the medical field? For example, when learning how to perform a specific medical procedure, choice in content, process, and product may not be acceptable and may have severe consequences.

If we were to repeat this study, we would keep the topics of the assignments but not create differentiated product options for the DI group until we had collected learning profiles and the instructor had spent time getting to know the students. Through using information from the learning profiles, the instructor would cater the product options of the assignments to the interests of the students.

Last Thoughts

Tomlinson (2008) and Wormeli (2007) both suggested that differentiation is an ethical issue. During the implementation of this study, we experienced many points of ethical dilemma as we reflected on the two sections. Many times the instructor questioned and struggled with the fairness of not differentiating for the

NDI group. After witnessing the academic improvements attained by the DI group, we question this decision even more now than before conducting the study. However, with the academic improvements witnessed in the students' learning and the overwhelmingly positive response that the lead author has received from students, the lead author cannot, in good conscience, nor would she want to, revert back to her former philosophy or mindset as a teacher. Even though she has just begun efforts to utilize differentiated instructional methods, with minimal extra effort, significant differences in the depth of her students' learning was noted.

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Appendix A
Assignments for NDI Section

General Instructions: Please put your number on the top of your paper. All written portions must be typed and double-spaced, with 1-inch margins and 10-12 point font. At least one full page is required for any writing assignment/reflection.

Assignment 1: After class lecture and discussion about the value of research, each student will write a reflection about one math intervention on either www.whatworks.ed.gov or Google intervention central and then explain why research is important to guide instruction. Include pros and cons about the intervention. Be sure to include one source that teacher's could use to guide them.

Assignment 2: After the class lecture and discussion on diversity in schools, each student will watch 15 commercials on TV observing whether the commercials starred a male or female, what ethnic group the individual belonged to, what the individual was selling, and what perceived class (lower, middle, upper) the individual was a member of? Create a table or graph displaying what you found, then write a reflection on how diversity in media can affect a child's self-efficacy in education.

Assignment 3: Through the use of a classical conditioning define a behavior that someone does and make three attempts to alter that person's behavior. In a written reflection, document what occurred and then create your own scenario of how a teacher could use classical conditioning to alter a child's behavior in school.

Assignment 4: Students will view a video from the PBIS (Positive Behavioral Supports in Schools) website showing system-wide models of Positive Behavioral Supports in school settings using a three-tiered model of intervention. Students will watch the video on their own time. Students will write a reflection explaining PBIS, explain how a PBIS school compared to your own school, and give your own opinion on PBIS.

Assignment 5: Students will work within collaborative groups. Each individual will be assigned a learning strategy to research and directly teach to the other members of the group. Afterwards, the student will write a reflection about the teaching experience and explain how the learning strategy could be used in a teaching experience. Also give your opinion of the strategy.

Assignment 6: Students will work to differentiate a lesson in reading. The student will create a written plan as to how to differentiate a lesson using Sternberg's Triarchic theory. For each intelligence, one must explain what the students should know, understand, and be able to do. Each of these learners must be taught at their zone of proximal development.

Assignment 7: After the class lecture on learning environments, students will draw the perfect learning environment for K-12 students; then, write a reflection of why this would be a good learning environment.

Appendix B
Assignments for DI Section

General Instructions: Please put your number on the top of your paper. All written portions must be typed and double-spaced, with 1-inch margins and 10-12 point font. At least one full page is required for any writing assignment/reflection.

Assignment 1: After the class lecture and discussion about the value of research, and sharing some of the interventions found with peers. Each student will read one research study from the National Undergraduate Research Clearinghouse, What Works Clearing House, or Intervention Central websites and write about any intervention of one's choice, include pros and cons of the intervention, and then write about the importance of research in guiding instructional decisions. Be sure to include one source that teacher's could use to guide them.

Assignment 2: After the class lecture and discussion on diversity in schools, each student will watch 15 commercials on TV observing whether the commercials starred a male or female, what ethnic group the individual belonged to, what the individual was selling, and what perceived class (lower, middle, upper) the individual was a member of? Create a table or graph displaying what you found then choose from the following:
- Write a reflection on how diversity in media can affect a child's self-efficacy in education
  OR
- Create a cartoon demonstrating how media can affect a child's self-efficacy in education
  OR
- Write a letter to the TV station about your concerns regarding a child's self-efficacy in education according to what you witnessed when watching the commercials.
  OR
- A creation of your choice that addresses how media affects a child's self-efficacy in education (okay your idea with the instructor).

Assignment 3: Through the use of a classical conditioning, or operant conditioning, or observational learning, define a specific behavior that someone currently does and make three attempts to alter that person's behavior. In a written reflection, document what occurred and then create your own scenario of how a teacher could use whichever conditioning you did to alter a child's behavior in school.

Assignment 4: Students will view a video from the PBIS (Positive Behavioral Supports in Schools) website showing system-wide models of Positive Behavioral Supports in school settings using a three-tiered model of intervention. Students will watch the video on their own time and (1) create a brochure on PBIS, (2) write a reflection on PBIS, or (3) create a 60 second video promoting PBIS. You must include an explanation of PBIS, explain how a PBIS school compared to your own school, and give your own opinion on PBIS.

Assignment 5: Students will work within collaborative groups. Each individual will choose a learning strategy that he/she would like to research and directly teach to the other members of the group. Then the student will write a reflection about the teaching experience and explain how this strategy could be used in a teaching experience. Also give your opinion of the strategy.

Assignment 6: Students will work to differentiate a lesson on one topic of one's choice. The student will create a written plan as to how one would differentiate a lesson using Sternberg's Triarchic theory or differentiate for three levels of learners: struggling learners, average learners, and above average learners. You must explain what the students should know, understand, and be able to do. Each of these learners must be taught at their zone of proximal development.

Assignment 7: After the class lecture on learning environments, students will design the perfect learning environment for K-12 students—for example, the student could create a diorama of the environment, a drawing of the environment, a computer layout of the environment—then write a reflection of why this would be a good learning environment.

Student and Faculty Beliefs About Learning in Higher Education: Implications for Teaching

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Beliefs about learning can influence whether or not a student learns course material. However, few studies in higher education have compared student and faculty beliefs about learning. In the current study, students and faculty agreed on many aspects of learning—including the definition of learning, which most hinders learning and where learning should take place—and had similar beliefs about learning styles. Though these similarities were mostly encouraging, beliefs about where learning should take place and in learning styles could undermine learning efforts. The implications of these beliefs are discussed and suggestions for promoting learning in the context of these findings are offered.

Understanding how faculty and students define and view learning can have important implications for faculty course design and assessment, as well as on student outcomes. The importance of beliefs about learning and their relationship to student learning outcomes has been noted (Edmunds & Richardson, 2009; Entwistle & Peterson, 2004; Richardson, 2005; Thielens, 1977). However, we were surprised by the lack of studies that compared both student and faculty definitions of learning, even though these definitions have been identified as important to learning outcome (see Entwistle & Peterson, 2004 for a review). For example, Thielens (1977) argued that learning behavior is based upon definition of learning, and Edmunds and Richardson (2009) found that conceptions of learning are correlated with learning approaches. Similarly, Entwistle and Peterson's (2004) review of educational literature indicated that both student and faculty conceptions of learning and knowledge are related to approaches to learning. Given the emphasis placed on assessing learning in higher education, and because beliefs about learning can influence how students study course material and how professors structure their classrooms, our aim was to capture and compare both student and faculty definitions of learning and assess the definitions' relationships to beliefs about learning.

A common definition of learning in higher education is fairly elusive. Some have created categories to capture the various definitions of learning garnered from learners (e.g., Marton, Dall'Alba, & Beaty, 1993; Richardson, 2005), while others have defined learning in traditional behaviorist terms: a relatively permanent change in behavior as a result of prior experience (see Lachman, 1997 for a review). Still, for others, learning is defined as a process (Lachman, 1997; Rogers, 1997). Recently, research has emphasized the difference between defining learning as a *product*, a consequence of learning (e.g., scores on assessments), versus a *process,* a change in behavior across time (e.g., grade improvement; Alexander,

Schallert, & Reynolds, 2009; Lachman, 1997; Rogers, 1997). Given the focus on learning styles at all levels of education and the trend in higher education to match teaching style to a student's learning style, it is also possible that some might even define learning as a style. But even in the educational literature, learning styles have been defined variably (Cassidy, 2004; Coffield, Moseley, Hall, & Ecclestone, 2004; Henson & Borthwick, 1984; Hyman & Rosoff, 1984).

Pashler, McDaniel, Rohrer, and Bjork (2008) argued that the popularity of learning styles stems from the wide-spread use of personality tests such as the Myers-Briggs, which categorize people by "type," ultimately giving way to the development of typed-based learning-style assessments. Proponents of the concept of learning styles continue to argue for its role in student learning outcomes and the utility of teaching to students' styles (e.g., Felder, 2010). Further, numerous college and university teaching centers across the US actively promote teaching to learning styles and even offer faculty resources for matching instruction methods to students' learning styles (Appendix A provides a random list of such collegiate websites). Their online resources promote the use of active learning or student centered teaching strategies precisely because these varied strategies target students with diverse learning styles and mitigate the problem of students with any one particular learning style being at a disadvantage. Though varying teaching approaches in the classroom is probably sound practice, the push to apply learning styles to pedagogical practices is a hasty one (Stahl, 1999). A recent review of the learning styles literature by Pashler et al. (2008) quite definitively concluded that few learning styles studies use the appropriate methodology necessary to detect the effects of learning styles on academic achievement, and those that do show that teaching to a student's learning style does not enhance learning. Unfortunately, the continued focus on teaching to learning styles could lead students to externalize reasons for poor performance as well as

create unnecessary obstacles to student learning by shifting faculty attention away from applying more empirically supported teaching and learning methods (Coffield et al., 2004; Riener, 2010). Because of the ubiquity of the notion of learning styles in higher education, we felt it important to capture whether student and faculty beliefs about learning styles were related to beliefs about learning.

Considering the diverse ways of defining learning, our first goal was to identify common faculty and student definitions of learning and to assess their relationship to beliefs about learning. A second goal, driven by the push to teach to learning styles in higher education, was to assess the impact of general beliefs about learning styles on beliefs about learning. For the purposes of this study, we targeted beliefs regarding where learning should take place, which poses the biggest hindrance to learning, whether learning styles exist, and whether teaching to a learning style enhances learning. We felt these beliefs represented areas of the most disagreement between students and faculty.

Pilot Study

Due to the lack of research comparing definitions of learning and their influence on beliefs about learning, we began with a pilot study that qualitatively captured faculty and student beliefs about learning. This initial work informed the specific hypotheses addressed in the current study. In our pilot study, 27 faculty and 101 students responded to open-ended questions regarding how they would describe learning and whom they felt most hindered student learning. These data revealed common themes in student and faculty descriptions of learning. For example, students described learning as the comprehension, using, describing, explaining, and interpreting of information (common theme: the ability to apply information), and as the acquiring and building of knowledge (common theme: the involvement of memory processes), and, to a lesser degree, as a style. Similarly, faculty described learning as a process that involved the acquisition and building of knowledge and the ability to apply information. However, faculty did not spontaneously define learning as a style. These descriptions of learning cited by our students and faculty closely resembled the conceptions of learning cited by students in other work (see Richardson, 2005 for a review), and ultimately informed the definitions of learning choices used in the current survey. Interestingly, when students and faculty were asked what factors most hindered student learning, students predominantly cited what we identified as external factors (namely teaching ability) and faculty predominantly cited what we identified as internal factors (namely the lack of interest, focus, and preparation of students).

Based on these qualitative results, we constructed a more specific measure of learning definition and beliefs about learning and were able to identify several specific hypotheses for the current study. From results of our pilot study, we expected that students and faculty would have similar definitions of learning but would disagree on whom (the professor or the student) represented the bigger hindrance to student learning, with more students citing the professor and more faculty citing the student. We also assumed that students and faculty would disagree on where learning takes place (inside or outside the classroom), with more students citing inside the classroom and more faculty citing outside the classroom. Furthermore, we hypothesized that students' beliefs about who hinders learning and where learning takes place would be mediated by a belief in learning styles. Some have argued that the focus on teaching to learning styles could lead students to externalize reasons for poor performance as well as create unnecessary obstacles to student learning (Coffield et al., 2004; Riener, 2010). Therefore, we specifically expected that a belief in learning styles would correspond to viewing the professor as the bigger hindrance to learning, the belief that teaching to their learning style would enhance learning and, consequently, the belief that learning primarily takes place inside the classroom.

To assess these hypotheses, we conducted a quantitative study aimed at comparing student and faculty definitions of learning and related factors that could affect student learning in higher education. The data reported here were part of a larger exploratory study assessing student and faculty beliefs about learning, studying and assessment. Our goal in the current study was to identify relationships between student and faculty beliefs about learning as a first step toward understanding how such beliefs might influence the learning process.

Method

Participants

We surveyed undergraduate students and faculty at one public and one private mid-sized Southeastern US undergraduate liberal arts university. One hundred sixty-four undergraduate students (134 women) responded to the survey. Students (age $M = 19.62$, $SD = 1.55$) represented 26 majors and four class levels (53 freshmen, 56 sophomores, 36 juniors, 19 seniors). Their mean GPA was 3.17 ($SD = 0.47$). Of the eighty-one faculty respondents (48 women), 23 different academic areas, five ranks (28 assistant, 16 associate, 20 full, 12 lecturer/instructor, four other), and four statuses (11 non-tenure track, 36 tenured, 27 tenure-track, six other) were represented. One faculty member preferred not to reveal rank or tenure status, and three did not reveal their gender.

Materials

The authors of this study created two web-based surveys designed to compare student and faculty views of learning. Both surveys collected demographic information and contained forced-choice, Likert-scaled, and open-response items. Portions of this survey were also used for a separate study to evaluate learning, studying, and assessment.

The student survey contained 76 items and the faculty survey included 37 items. Survey length varied as a function of the nature of the items. Both faculty and students were asked questions about their own definition of learning, where they believed learning should take place, and whom they believed hinders learning. However, as part of a separate project, students were also asked additional questions pertaining to the methods they used to study for certain courses, their motivation for studying, specific techniques used when studying, and several questions regarding their perceived learning style(s).

The response choices provided for both the forced-choice and the Likert-scaled questions were compiled from student and faculty answers to open-ended-questions from the pilot study described earlier. The main goal of the current study was only to capture specific information regarding student and faculty beliefs about learning. Therefore, we used the common themes that emerged from these initial open-ended questions (see Table 1) when constructing the forced-choice questions for the current survey. Examples of forced choice learning questions across respondent groups include, "What is your definition of learning? Choose the one definition that best fits your concept of learning?" and "Given your experience, who is the bigger hindrance to undergraduate student learning?" Learning styles and beliefs about these styles were assessed with forced choice questions such as, "Do you agree with this statement? People have different learning styles" and "What was your determined dominant learning style?" Likert scales were used to capture information for another study. Appendix B is a full copy of the survey.

Procedure

At both universities, students and faculty were recruited via electronic mailing lists. In addition, we made use of our department's online participant recruitment website through which students could gain course research credit or extra credit for their participation. Participants were fully informed that the intent of our study was to assess beliefs about

Table 1
Items from the Faculty and Student Pilot Study

Target	Survey items
Faculty	1. What type of student do you primarily teach?
	2. Do you think undergraduate students study differently for courses in their major versus outside their major?
	3. Why do you think some students study differently for courses in their major?
	4. List the studying techniques you think students use (for courses in and outside their major).
	5. Regarding your courses, how would you describe "learning"?
	6. Regarding your courses, list any factors you think hinder student learning.
	7. Regarding your courses, what do you think is the best way to assess (measure) student learning?
	8. What do you think motivates students to STUDY.
	9. How accurately does course grade reflect how much students have learned?
	10. How motivated are students to study for classes OUTSIDE their major?
	11. How motivated are students to study for classes IN their major?
	12. How well do student's study strategies work for them in terms of their learning?
Students	1. Do you typically study differently for courses in your major versus outside your major?
	2. If you answered "Yes" above, tell us WHY you study differently for courses in your major.
	3. List the studying techniques you use (for courses in and outside your major).
	4. Regarding your courses, how would you describe "learning"?
	5. Regarding your courses, list any factors you think hinder your learning.
	6. Regarding your courses, what do you think is the best way to assess (measure) your learning?
	7. Tell us what motivates YOU to STUDY.
	8. How accurately do your course grades reflect how much you have learned?
	9. How motivated are you to study for classes IN your major?
	10. How motivated are you to study for classes OUTSIDE your major?
	11. How well have your study strategies worked for you in terms of your learning?

Note. Demographic questions are not included. Student $n = 101$. Faculty $n = 27$.

undergraduate learning and assessment (for faculty) or to assess beliefs about undergraduate learning and studying (for students) and that relevant student and faculty responses would be compared. All responses were collected anonymously.

Surveys were created with Google Drive, and all data responses were collected through this online service. Participants were provided with a web link for their respective survey and could take the survey at any location with a computer and internet access. When participants clicked on the provided link, they were immediately taken to a webpage containing a brief summary of the study and the consent form. After granting their consent, participants could begin answering the study questions. Both surveys began with the demographic questions, and questions were grouped into separate sections (e.g., demographic questions, course assessment, learning). Each survey page contained a grouping of these questions (rather than one question per page) and should have taken less than 20 minutes to complete.

Results

Main Hypotheses

Student and faculty definitions and beliefs about learning. Results supported some, but not all, predictions. There were no significant relationships between learning definitions and beliefs regarding where learning should take place, who poses the biggest hindrance to learning, whether learning styles exist, or whether teaching to a learning style enhances learning. However, as expected, students and faculty had similar definitions of learning. The most common definition chosen by both students and faculty was, "Learning is the comprehension and use of knowledge." Because our data violated the chi-square assumption that less than 80% of the cells had expected counts of five, we used a Fisher exact test to assess the relationship between learning definition and participant status (student or faculty). This test revealed a significant dependent relationship between participant status and learning definition, $p = .024$, but no residuals exceeded the critical value of 1.96 (see Aspelmeier & Pierce, 2009 for an overview of the interpretation of crosstab residuals); we did not find that any specific definition was more or less expected across participant status. Contrary to our predictions, students and faculty agreed on who most hindered learning (students or faculty), with a majority of students and faculty citing the student as the biggest hindrance. Similarly, a majority of students and faculty agreed that learning should take place "equally inside and outside the classroom." Chi-square tests of independence revealed that participant status (student or faculty) was significantly related to

beliefs about who poses the biggest hindrance to learning, $\chi^2(2, N = 245) = 8.03$, $p = .018$, and related to beliefs about where learning should take place, $\chi^2(2, N = 245) = 19.73$, $p = .000$. Belief about hindrance to learning was dependent on participant status; however, no standardized residuals exceeded the critical value of 1.96 (therefore participant status did not affect hindrance). Regarding beliefs about where learning takes place, standardized residuals showed that fewer faculty stated that learning should take place primarily in the classroom and more faculty stated that learning should take place primarily outside the classroom than would be expected by the chi-square test of independence. Table 2 summarizes the student and faculty percentages for the learning definitions and beliefs about where learning takes place and who most hinders learning.

Student beliefs about learning styles and their relationship to beliefs about learning. Finally, we wanted to assess our hypotheses regarding student and faculty beliefs about learning styles. A majority of students stated that they had a learning style. Furthermore, a majority of faculty and students believed that teaching to a student's learning style would enhance student learning. Figure 1 depicts the differing responses of students and faculty to the question of whether teaching to a learning style enhances learning. Results of a chi-square test for independence revealed that faculty were significantly more likely than expected to disagree that teaching to a student's learning style would enhance student learning, and students were significantly less likely than predicted to disagree that teaching to a student's learning style would enhance student learning, $\chi^2(2, N = 245) = 22.17$, $p = .000$. Further, because our data violated the chi-square assumption that less than 80% of the cells had expected counts of five and we had a 3 x 3 crosstab, we used a Cramer's V test to address whether this belief of teaching to learning styles was associated with beliefs about who hinders learning and where learning should take place. There were no significant results regarding who hinders learning suggesting that belief of teaching to learning styles was unrelated to ideas about who hinders learning. However, faculty who do not believe that teaching to a student's learning style would enhance student learning were significantly more likely to state that learning should take place primarily outside of the classroom than expected by this statistical test, $p = .030$. No significant results were found for students.

Additional Analyses

Student and faculty characteristics and their relationship to beliefs about learning. Our main concepts of learning definition, hindrance, place and

Table 2
Student and Faculty Response Frequencies to Beliefs About Learning

Survey items	Frequency (%)	
	Student	Faculty
Definition of learning		
Learning is the comprehension and use of knowledge	72 (44%)	48 (59%)
Learning is the acquisition and building of knowledge	58 (35%)	27 (33%)
Learning is a style or an approach to gaining knowledge	28 (17%)	6 (7%)
Learning is the remembering of knowledge	6 (4%)	0 (0%)
Where learning should take place		
Equally inside and outside the classroom	109 (67%)	60 (74%)
Primarily in the classroom	50 (30%)	9 (11%)
Primarily outside the classroom	5 (3%)	12 (15%)
Who most hinders student learning		
The Student	90 (55%)	42 (52%)
Prefer not to choose	37 (23%)	30 (37%)
The Instructor	37 (23%)	9 (11%)

Note. Student ($n = 164$) and faculty ($n = 81$) percentages were rounded to the nearest whole number.

Figure 1
Responses to the Question "Does Teaching to a Student's Learning Style Enhance Learning?"
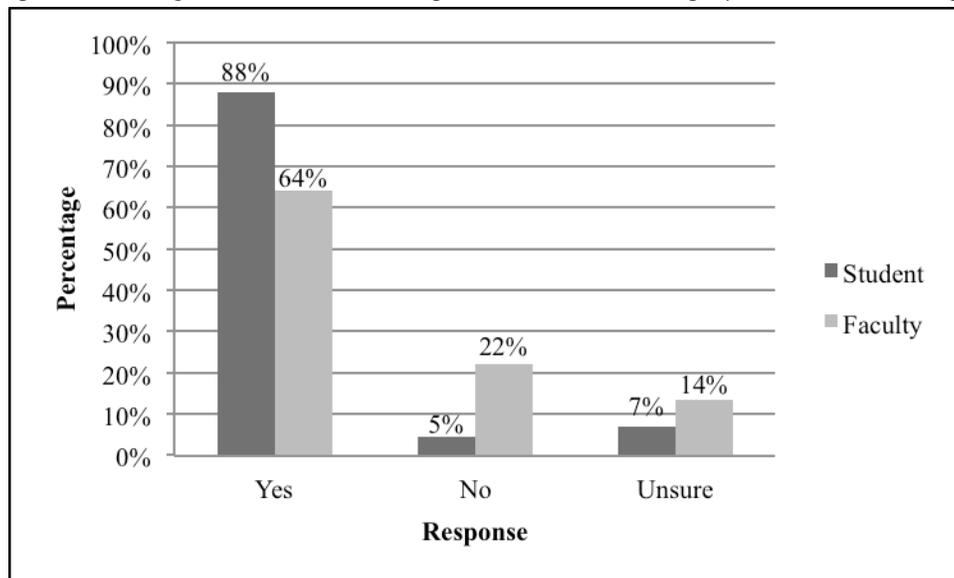
Note. The figure includes percentage of students ($n = 164$) and faculty ($n = 81$) who answered *Yes, No,* or *Unsure* to the question: "Does teaching to a student's learning style enhance learning?" Percentages were rounded to the nearest whole number.

style were also analyzed separately by faculty characteristics (i.e., tenure status, rank, and department area) and student class level (i.e., freshman, sophomore, junior, senior) to assess whether the results reported above were pertinent to a specific faculty characteristic or student class level. None of the faculty characteristics were significant. There were no significant differences among class levels and learning definition, hindrance, or place. However, a Cramer's V, $p = .000$, did indicate a relationship between class level and the belief that teaching to a learning style would enhance student learning. This relationship was significant only for seniors. Specifically, a more than expected number of seniors did not believe that teaching to a learning style enhanced learning. A similar trend regarding whether learning styles exist was also found among the senior students (Cramer's V, $p = .000$). More seniors than expected did not believe in the existence of learning

styles. Of note, the number of seniors assessed was less than half the size of the other groups.

Discussion

The current study was an examination of student and faculty beliefs about learning as a step toward understanding how these beliefs might influence the learning process. While we did not find a relationship between specific definitions of learning and beliefs about where learning should take place, who poses the biggest hindrance to learning, whether learning styles exist, or whether teaching to a learning style enhances learning, we did find that students and faculty agreed on these aspects of learning.

Overall, we were encouraged that students and faculty had similar beliefs regarding learning, as this provides an opportunity for better communication between faculty and their students. However, we did identify some concepts of learning that could potentially hamper faculty's best intentions to promote learning. Despite these seeming incompatibilities, we believe that the similarities in faculty and student beliefs about learning still offer a means for promoting student learning.

Because students and faculty agreed that learning is "the comprehension and use of knowledge," there is an opening for faculty to discuss and address this definition of learning in the classroom. Faculty can openly explain the student's role in comprehending and using course information and offer various study strategies, tailored for the specific subject matter, that would help students achieve comprehension. An important piece to gaining the ability to use knowledge is that students continue to revisit the material outside of class. Karpicke (2012), for example, suggests using retrieval based learning strategies to promote meaningful learning. The practice of retrieving information, following initial exposure to course material, has been shown to significantly improve conceptual learning (Karpicke & Blunt, 2011). Students and faculty agreed that the student is the biggest hindrance to learning. However, because students and faculty also agreed that learning should take place equally inside and outside the classroom and that teaching to learning styles enhances learning, convincing students of their role in learning how to apply material could be a challenge.

Although faculty and student opinions on the sources of student hindrance probably vary, our pilot study showed that both agreed that students' lack of preparation, motivation and distractions beyond the class (e.g., family, friends, activities) hindered learning. Thus, an initial frank discussion of the instructor's expectation that students not only be able to comprehend but also use course information is an important step toward addressing preparation and motivation issues (metaphorically lighting the fire under them). Further, faculty could design their course in such a way that it facilitates the expected application of knowledge. Evidence suggests that the adoption of different study strategies by college students can be influenced by the type of assessment (e.g., Feldt & Ray, 1989; McDougall & Granby, 1996), therefore one suggestion for faculty is to directly test application ability on exams or assign coursework that encourages application. Regarding where learning takes place, it would also be helpful for faculty to set a classroom tone that although comprehension and use of material begins in the classroom, it must continue beyond the classroom. Unfortunately, since faculty similarly believe that learning should take place equally in and out of the classroom they might not be emphasizing that students should be spending even more time outside (than inside) of class promoting learning (e.g., studying and applying the material). The instructor could stress that students need to find a way to balance life distractions with the expected workload outside of the classroom, but we think it would be more productive to concretely convey how much time they are expected to devote to the course beyond the classroom. For example, an instructor might explain that they expect the students to spend double the amount of time studying that they spend in class each week.

Similarly, faculty and student belief that teaching to learning styles enhances learning only serves to undermine faculty efforts. If the goal is comprehension and application, faculty need to spend their time teaching concepts and promoting application of material. Although there are many teaching models available that might promote such learning (e.g., Karpicke, 2012; Karpicke & Blunt, 2011), the evidence (e.g., Pashler, et al., 2008) clearly suggests that teaching to learning styles is not one of them. Our data show that students seem to have been told they do have a learning style; however, we find it promising that a quarter of the students indicated that they have no idea what it is, and by their senior year they seem to be dispensing with the notion all together. This is good news given the lack of evidence supporting learning styles. Faculty have the opportunity when designing their course to promote the adoption of effective study strategies based on the type of assessment given rather than concerning oneself with how other factors, such as learning styles, affect the learning process. Faculty should instead focus on teaching to their definition of learning, a definition that students share, and work towards teaching students how to address the key learning components both inside and outside the classroom.

Although a majority of faculty agreed that teaching to a student's learning style enhanced learning, more than expected disagreed with this notion. This trend

was not found for students, suggesting that faculty might be less convinced than students that learning style is important in the learning process. However, while faculty's beliefs regarding whether or not teaching to a student's learning style enhanced learning did not mediate beliefs about who poses the biggest hindrance to learning, it did mediate beliefs about where learning should take place. Specifically, faculty who did not believe that teaching to a student's learning style would enhance learning were more likely to believe that learning should take place primarily outside the classroom. This suggests that faculty views about learning style might in fact influence their expectations of students (e.g., expectations of where they engage in learning). More research on these views would help clarify whether faculty who do support teaching to a learning style are actually hindering learning by emphasizing too much inside the classroom and not enough beyond it.   Additionally, one reason why student beliefs about teaching to a student's learning style differed from faculty's could be due to how respondents personally defined 'earning style. This is entirely possible given the varying definitions of learning style that exist even within that field (e.g., Cassidy, 2004). We assumed that students would define learning style much in the same way as faculty, but this may not have been the case. Regardless, we still endorse a focus on teaching to one's definition of learning rather than style.

In summary, our findings support the idea that beliefs about learning could influence both the process (e.g., classroom engagement and studying) and product (e.g., grades) of learning, and they suggest that students and faculty agree more about the process of learning than once thought (Thielens, 1977). They not only share similar definitions of learning, but also agree on where learning takes place, and who hinders student learning. Thus, faculty and student concepts of learning hold important implications for how faculty interact with students, design their courses, and assess student learning.

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Acknowledgments

Appendix A
Sample List of Collegiate Teaching Center Websites Supporting Teaching to Learning Styles

http://www.crlt.umich.edu/tstrategies/tsls
http://fod.msu.edu/oir/learning-styles-teaching-styles-multiple-intelligences
https://www.sc.edu/cte/guide/teachingstyles/index.shtml
http://www.cte.cornell.edu/teaching-ideas/engaging-students/learning-and-teaching-styles.html
http://www.tlpd.ttu.edu/teach/TLTC%20Teaching%20Resources/LearningStyles.asp
https://www.washington.edu/doit/TeamN/learn.html
https://www.fontbonne.edu/academics/academicresources/centerforexcellenceinteachinglearning/understandingand
motivatingstudents/learningstylesanddifferentiatedinstruction/
http://www.ion.uillinois.edu/resources/tutorials/pedagogy/instructionalstrategies.asp

Appendix B
Examples of the Student and Faculty Surveys Used in the Current Study

Student Online Survey:
(Consent form is not included)

Answer these questions honestly and thoughtfully.

All the information you provide is anonymous.

We ask that you give these questions your full attention. Please do not answer email, phone, or text messages or engage in other activities (e.g., watching TV) during this survey.

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Undergraduate Survey of Learning and Studying

Part I. Demographic Information

Answer the following questions as directed.

What is your gender? *
- ○ Male
- ○ Female
- ○ Prefer not to answer

Type your age below. *
Use numerals, for example: 20
[   ]

Choose your current major (if you are a double major, choose the major for which you have taken the most classes): *
| Accounting   ▲▼ |

Indicate your class standing based on current credit hours. *
- ○ Freshman (0-29 semester credit hours)
- ○ Sophomore (30-59 semester credit hours)
- ○ Junior (60-89 semester credit hours)
- ○ Senior (90 and above semester credit hours)
- ○ Graduate student
- ○ Other

Type your current overall GPA below *
For example: 2.59
[   ]

Part II. Learning

What is your definition of learning? *
Choose the one definition that best fits your concept of learning.

- ◯ Learning is a style or an approach to gaining knowledge.
- ◯ Learning is the comprehension and use of knowledge.
- ◯ Learning is the acquisition and building of knowledge.
- ◯ Learning is the remembering of knowledge.

Given the definition you chose above, which exam type do you think best leads to your better learning the material? *

- ◯ Multiple-choice only exams
- ◯ Essay only exams
- ◯ Multiple-choice/Essay combined exams
- ◯ Cumulative exams
- ◯ Papers/Writing projects
- ◯ Presentations (individual)
- ◯ Group activities (includes group presentations)

Given your experience, who is the bigger hindrance to undergraduate student learning? *
Please choose one answer.

- ◯ The student.
- ◯ The professor.
- ◯ Prefer not to choose.

Complete this sentence, "I think undergraduate student learning should take place..." *
Please choose one answer.

- ◯ primarily in the classroom."
- ◯ primarily outside the classroom."
- ◯ equally inside and outside the classroom."

Part II. Learning (continued)

Do you agree with this statement? "People have different learning styles." *

- ◯ Yes

○ No
○ I'm not sure.

Do you agree with this statement? "I think that teaching to my learning style enhances my learning." *
○ Yes
○ No
○ I'm not sure.

Have you, or has someone else, determined that you have a particular learning style? *
○ Yes
○ No
○ I'm not sure.

What was your determined dominant learning style? Choose one answer only. *
Learning style is usually determined with a questionnaire. Choose, "I don't know" if you've never taken a learning style questionnaire/inventory.
○ Visual
○ Auditory/Aural
○ Kinesthetic/Physical/Tactile
○ Verbal/Linguistic
○ Logical/Mathematical
○ Social/interpersonal
○ Solitary/intrapersonal
○ Active
○ Reflective
○ Sensing
○ Intuitive
○ Sequential
○ Global
○ An equal combination of styles.
○ I don't know.
○ I don't remember.
○ Other

Using the scale below, Indicate your level of agreement with each of the following statements regarding course grades.

1 = Strongly Disagree
3 = Neutral
5 = Strongly Agree

*

	1 SD	2	3 N	4	5 SA
In general, course grades accurately reflect how much I have learned in a course.	○	○	○	○	○
In general, course grades accurately reflect how much time I put into a course.	○	○	○	○	○
In general, course grades accurately reflect how much information I understand in a course.	○	○	○	○	○
In general, course grades accurately reflect how much effort I put into a course.	○	○	○	○	○

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Part III. Studying

Indicate why you might study differently for courses in your major (versus your non-major/elective courses):
*
Choose the one answer that fits you best.
○ I do not study differently for courses in my major.
○ Courses in my major are more difficult.
○ Courses in my major are more relevant to my future.
○ Courses in my major mean more to me (I care more about them).
○ Courses in my major are more interesting.
○ Courses in my major have a GPA requirement.
○ Courses in my major require more time.

Think of one of your typical courses. Chose the appropriate discription below. *
Chose one answer.
○ This course is a lower level course in my major (I have to take this course for my major).
○ This course is an upper level course in my major (I have to take this course for my major).
○ This course is a lower level course outside my major (I do not have to take this course for my major).
○ This course is an upper level course in my major (I have to take this course for my major).
○ Other

Thinking of the course you chose above, what is your main goal when you study for this course? *

Choose the one answer that fits you best.

○ To remember the material for the exam.

○ To remember the material beyond college.

○ To understand the material.

○ To be able to apply the material.

○ To be able to recognize the material for the exam.

○ I do not study for this course.

Thinking of the course you chose above, indicate your level of agreement with each of the following statements regarding your studying techniques.

Use the following scale:
1 = Strongly Disagree
3 = Neutral
5 = Strongly Agree

*

	1 SD	2	3 N	4	5 SA
I usually use flash/note cards to help me memorize when I study.	○	○	○	○	○
I usually use flash cards or note cards as prompts to come up with examples or applications of concepts when I study.	○	○	○	○	○
I usually re-read all the course material when I study.	○	○	○	○	○
I usually read over all the course material when I study.	○	○	○	○	○
I usually memorize all the concepts in the course material (without the aid of flash/note cards) when I study.	○	○	○	○	○
I usually try to explain the course material to others when I study.	○	○	○	○	○
I usually try to elaborate (relate the information to things I already know) on the course material when I study.	○	○	○	○	○

I usually try to apply the course material to other situations or settings when I study.	○	○	○	○	○
I usually make up and later answer my own test questions when I study.	○	○	○	○	○
I usually re-write/type all my notes when I study.	○	○	○	○	○
I usually do additional readings of the course topics (readings that are not required).	○	○	○	○	○

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Part III. Studying (continued)

Now consider ALL of your courses. For each scenario below, indicate your level of agreement with the use of each study technique.

Use the following scale:
1 = Strongly Disagree
3 = Neutral
5 = Strongly Agree

If you just want to pass an exam (i.e., get a "C"), you would: *

	1 SD	2	3 N	4	5 SA
Create and memorize flash/note cards.	○	○	○	○	○
Create and use flash/note cards as prompts to come up with examples or applications.	○	○	○	○	○
Re-read assigned material.	○	○	○	○	○
Read assigned material.	○	○	○	○	○
Memorize course concepts (without the aid of flash/note cards).	○	○	○	○	○
Explain the course material to others.	○	○	○	○	○
Elaborate on the course material (relate it to things you already know).	○	○	○	○	○

	1 SD	2	3 N	4	5 SA
Apply the course material to other situations or settings	○	○	○	○	○
Make up and later answer your own test questions.	○	○	○	○	○
Re-write/type your notes when you study.	○	○	○	○	○
Do additional readings on the course topics (readings that are not required).	○	○	○	○	○

If you want to get an "A" on an exam, you would: *

	1 SD	2	3 N	4	5 SA
Create and memorize flash/note cards.	○	○	○	○	○
Create and use flash/note cards as prompts to come up with examples or applications.	○	○	○	○	○
Re-read assigned material.	○	○	○	○	○
Read assigned material.	○	○	○	○	○
Memorize course concepts (without the aid of flash/note cards).	○	○	○	○	○
Explain the course material to others.	○	○	○	○	○
Elaborate on the course material (relate it to things you already know).	○	○	○	○	○
Apply the course material to other situations or settings	○	○	○	○	○
Make up and later answer your own test questions.	○	○	○	○	○
Re-write/type your notes when you study.	○	○	○	○	○
Do additional readings on the course topics (readings that are not required).	○	○	○	○	○

If you have an upcoming multiple choice exam, you would: *

	1 SD	2	3 N	4	5 SA
Create and memorize flash/note cards.	○	○	○	○	○
Create and use flash/note cards as prompts to come up with examples or	○	○	○	○	○

applications.					
Re-read assigned material.	○	○	○	○	○
Read assigned material.	○	○	○	○	○
Memorize course concepts (without the aid of flash/note cards).	○	○	○	○	○
Explain the course material to others.	○	○	○	○	○
Elaborate on the course material (relate it to things you already know).	○	○	○	○	○
Apply the course material to other situations or settings	○	○	○	○	○
Make up and later answer your own test questions.	○	○	○	○	○
Re-write/type your notes when you study.	○	○	○	○	○
Do additional readings on the course topics (readings that are not required).	○	○	○	○	○

If you have an upcoming essay exam, you would: *

	1 SD	2	3 N	4	5 SA
Create and memorize flash/note cards.	○	○	○	○	○
Create and use flash/note cards as prompts to come up with examples or applications.	○	○	○	○	○
Re-read assigned material.	○	○	○	○	○
Read assigned material.	○	○	○	○	○
Memorize course concepts (without the aid of flash/note cards).	○	○	○	○	○
Explain the course material to others.	○	○	○	○	○
Elaborate on the course material (relate it to things you already know).	○	○	○	○	○
Apply the course material to other situations or settings	○	○	○	○	○
Make up and later answer your own test questions.	○	○	○	○	○

Re-write/type your notes when you study.	○	○	○	○	○
Do additional readings on the course topics (readings that are not required).	○	○	○	○	○

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Part III. Studying (continued)

What most motivates you to STUDY for any of your courses? *
Choose the one answer that fits you best.

○ I study because my family expects me to.

○ I study to earn better grades.

○ I study to earn a certain GPA (grade point average) so I can keep a scholarship.

○ I study to earn a certain GPA (grade point average) because of personal drive, self-esteem, or competitiveness.

○ I study because I like gaining new knowledge.

○ I study because I will need the information for graduate school or for a job.

○ I study because my friends do it.

○ I do not study.

○ Other.

Student Online Survey:
(Consent form is not included)

Faculty Survey of Undergraduate Learning & Assessment

This is an investigation of faculty beliefs about undergraduate learning and assessment. It involves less than 20 choice response questions. Faculty answers will be aggregated and, where relevant, compared with those of students. The entire survey should take less than 10 minutes.

All information is gathered anonymously.

Preliminary Question

What type of student do you primarily teach? *
Choose the student you mainly teach.
○ Undergraduate
○ Graduate

Part I. Demographic Questions

Answer the following 5 questions as directed.

What is your gender? *
○ Male
○ Female
○ Prefer not to answer

Choose your rank. *
○ Full professor
○ Associate professor
○ Assistant professor
○ Lecturer/Instructor
○ Other
○ Prefer not to answer

Choose your rank status. *
○ Tenured
○ Untenured, tenure-track
○ Non tenure-track
○ Other
○ Prefer not to answer

Choose the primary academic area in which you teach. *
(College of Arts & Sciences) Art ▲▼

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Part II. Course Requirements

Choose one of your typical undergraduate courses and keep this course in mind as you answer the next

question. Indicate below what type of course you chose. *

○ My chosen course is an upper level (junior/senior) course.

○ My chosen course is a lower level (freshman/sophomore) course.

Indicate how often you currently use each type of course requirement in your chosen course. *
Consider all values on the scale below (not just those labeled).

	1 Never	2	3 Sometimes	4	5 Always
Multiple-choice only exams	○	○	○	○	○
Essay only exams	○	○	○	○	○
Multiple-choice/essay combined exams	○	○	○	○	○
Cumulative exams	○	○	○	○	○
Presentations (individual)	○	○	○	○	○
Group Activities (includes group presentations)	○	○	○	○	○

What is your definition of learning? *
Choose the one definition that best fits your concept of learning.

○ Learning is a style or an approach to gaining knowledge.

○ Learning is the comprehension and use of knowledge.

○ Learning is the acquisition and building of knowledge.

○ Learning is the remembering of knowledge.

Indicate the potential of each course requirement to capture the definition of learning you chose above: *
Consider all values on the scale below (not just those labeled).

	1 Low potential to capture my learning definition	2	3 Moderate potential	4	5 High potential to capture my learning definition
Multiple-choice only exams	○	○	○	○	○
Essay only exams	○	○	○	○	○
Multiple-choice/Essay combined exams	○	○	○	○	○
Cumulative exams	○	○	○	○	○
Papers/Writing projects	○	○	○	○	○
Presentations (individual)	○	○	○	○	○
Group Activities (includes group presentations)	○	○	○	○	○

Part III. Course Assessment

Course Assessment Definition:

Any measure of student learning outcomes that is not part of the instructor's regular course requirement and whose data are submitted to others. These assessments are typically stipulated by a university's administration. These may or may not include assessments created by the instructor. An example of a course assessment would be an evaluation of students' knowledge in a specific course, the data (typically aggregated across instructors of the same course) would then be submitted to an administrator (e.g., department chair, dean, provost, etc...). This assessment is NOT typically used to assign student grades.

Using the definition above, which one is true for you: *
Please choose one answer.

○ I conduct a voluntary course assessment in at least one of my undergraduate courses.

○ I have been directed to conduct a course assessment in at least one of my undergraduate courses.

○ I have not been directed to conduct course assessments in any of my undergraduate courses.

○ I am unsure.

Using the definition above, are you resistant to the idea of undergraduate course assessment? *
Please choose one answer.

○ Yes

○ No

○ Unsure

Using the definition above, indicate how strongly you agree or disagree with each of the following statements: *

	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree
Course assessments intrude on teaching/class time.	○	○	○	○	○
Course assessments might be used as a measure of teaching ability.	○	○	○	○	○
Course assessments are inconvenient.	○	○	○	○	○
Course assessments are poorly constructed.	○	○	○	○	○
Course assessments are the best way to measure student learning outcome.	○	○	○	○	○

	Course assessments are the only way to measure student learning outcome.	○	○	○	○	○

Using the definition above, indicate how strongly you agree or disagree with each of the following statements: *

	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree
Course assessments are no better than final grades at capturing student learning outcomes.	○	○	○	○	○
Course assessments do not capture the students' responsibility in the learning process.	○	○	○	○	○
Course assessments do not adequately measure student learning outcomes.	○	○	○	○	○

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Part IV. Student Learning

Please answer each question below.

Given your experience, who is the bigger hindrance to undergraduate student learning? *
Please choose one answer.
○ The student
○ The instructor
○ Prefer not to choose

Complete this sentence, "I think that undergraduate student learning should take place... *
Please choose one answer.
○ primarily in the classroom."
○ primarily outside the classroom."
○ equally inside and outside the classroom."

Do you agree with this statement? "I think that teaching to a student's learning style enhances student learning." *

Please choose one answer.

◯ Yes

◯ No

◯ Unsure

Do you agree with this statement? "I think that teaching to a student's learning style will lead to better course assessment outcome." *

Please choose one answer.

◯ Yes

◯ No

◯ Unsure

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Your Feedback

This section is optional. You may continue to the next page if you do not wish to provide feedback.

Do you have any comments regarding course assessments?

Please provide your comments in the text box below.

Do you have any comments regarding student learning?

Please provide your comments in the text box below.

Do you have any comments regarding this survey?

Please provide your comments in the text box below.

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Thank you for your interest in our study.

Using Student Choice to Increase Students' Knowledge of Research Methodology, Improve Their Attitudes Toward Research, and Promote Acquisition of Professional Skills

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Students often approach their research methods course with dread typically because of the broad and abstract nature of the content. In the study presented here, we introduced a variety of student-driven, content-specific assignments that allowed for a more active learning experience when compared to the typical research methods course. Providing a range of student choice in the research methodology curriculum offers the advantage of incorporating an active learning approach as well as fostering an environment that promotes students' intrinsic motivation for learning the material. After completing this course, students reported a significant gain in skill acquisition and showed significant gains in knowledge of research methods, and they reported improved attitudes toward research. An examination of the pre-course student characteristics and their correlations with post-course student characteristics suggests that this kind of approach to teaching was effective for a range of students. These findings lend support to the growing body of literature that suggests that students learn best when they are actively engaged in the process and are most intrinsically motivated when they feel they have autonomy over their learning.

Across many disciplines both the importance of teaching research methodology along with the difficulties associated with this task are well known. Those teaching in a range of content areas, including public health (Hovell, Adams, & Semb, 2008), political science (Turner & Thies, 2009), psychology (Freng, Webber, Blatter, Wing, & Scott, 2011), sociology (Shostak, Girouard, Cunningham, & Cadge, 2010; Singleton, 2007), social work (Reinherz, Regan, & Anastas, 1982), and education (Onwuegbuzie, 2001), discuss challenges or possible solutions to this endeavor. While those teaching graduate students also face challenges teaching research methods to their growing professionals (Reinherz et al., 1982), teaching undergraduates presents its own unique obstacles. Many undergraduate departments require that students complete a methods course near the beginning of their college careers. Students taking this course early in their academic trajectories benefit from this by building critical thinking skills necessary to evaluate the knowledge they gain through subsequent content courses (Freng et al., 2011). Moreover, this approach allows for the cumulative development of students' professional and intellectual skills (Kain, Buchanan, & Mack, 2001). This early placement of the research methods course presents a pedagogical dilemma; students must gain research knowledge before moving on to other courses but it is difficult for them to learn methodological skills without exploring a specific content area.

Students are, therefore, often faced with dual task of developing an understanding of abstract research concepts without a requisite foundation of concrete content knowledge in which these abstract notions can be applied successfully. As Jean Piaget and others have noted, it is difficult to master an abstract knowledge of any phenomena without a basic concrete understanding of its principles (Lawson & Wollman, 2003). Moreover, students become disconnected from the process and have difficulty linking the methodological skills they are asked to develop with their academic, personal, and professional goals (Sizemore & Lewandowski, 2009). Perhaps this is why many students approach their methodology courses with apprehension or anxiety (Papanastasiou, 2005) and report more enthusiasm for registering for content-driven courses (Rajecki, Appleby, Williams, Johnson, & Jeschke, 2005). This is unfortunate, because many studies suggest that students are more able to sustain devotion to their studies when they feel intrinsically motivated to pursue subjects that are consistent with their purposes and goals (Butler, 2000; Linnenbrink & Pintrich, 2000). The self-determination theory of motivation suggests that human beings simultaneously have needs for autonomy, competence, and relatedness (Ryan & Deci, 2000; Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004). Theoretical models (Ryan & Deci, 2000) and empirical evidence (Vansteenkiste et al., 2004) suggest that humans thrive in circumstances that satisfy these needs for autonomy, competence, and relatedness. It is under these conditions that we are likely to be intrinsically motivated to learn and perform at our peak. To the extent that personal autonomy and competence needs are met, students are more engaged with an activity and are more likely to be persistent (Vansteenkiste et al., 2004).

The theoretical and empirical literature would, therefore, suggest that learning occurs best when students, who feel that they have been given autonomy and choice, are also pursuing activities that provide them with a forum in which they might engage in

concrete experiences upon which a more abstract understanding can be built. Several instructors and researchers have included various features of these ideals in their methodology courses. For example, Longmore, Dunn, and Jarboe (1996) discussed a curriculum in which students developed and administered their own survey examining a student-chosen research question. The authors reported that this student-choice was an important component to the success of this approach to teaching, but these choices rested with individual groups of students and not with a class-wide activity. Singleton (2007), however, described a curriculum for teaching research methodology that involved institutional research conducted by the class as a whole. The benefits of this approach were that the campus survey provided a "constant source of examples in the methods course" (Singleton, 2007, p. 53). However, the research question was ultimately chosen by the professor who also developed the first draft of the survey used in the study. Similarly, Kain, Buchanan, and Mack (2001) asked students to conduct telephone interviews with college alumni or sociology majors, and Chapdelaine and Chapman (1999) asked students to conduct community-based research regarding residents' attitudes toward police involvement in domestic violence cases. Students were given some choices in the implementation of these studies but they were not given full autonomy over the research process.

While many instructors have included some student autonomy and concrete learning experiences in their methodologies, few of these studies have examined the related outcomes in students' reported experience and attitudes toward research or their gains in knowledge of research methodology. Even when instructors are able to document improvements in knowledge, sometimes this improved knowledge is associated with a decline in positive attitudes toward research (Sizemore & Lewandowski, 2009). One recent study employed a pedagogical technique that involved elaborate scaffolding beginning with a critical analysis of a research article, leading to a demonstration of an experimental design, and ending with the implementation of students' own experiments (Ciarocco, Lewandowski, & Van Volkom, 2013). Students were not given the opportunity to choose their research question in this approach, but this curriculum still resulted in improvements in student-reported attitudes towards research.

The current study aims to investigate a research methods curriculum which scaffolds student understanding by capitalizing on both this active learning methodology shown to be effective in teaching science-related material (Michael, 2006) while also maximizing students' ability to feel connected with the material. Moreover, changes in student understanding

of the material, their related professional experiences, and their attitudes toward research are examined. In this research methodology course, the two main assignments were designed to promote students' sense of autonomy and enthusiasm through both group and individual assignments. Individual assignments revolved around the development of a written research proposal, on a topic chosen by the student individually on some area of personal interest. Group projects revolved around conducting a study of some aspect of student life on a topic chosen by the class as a whole. This approach benefits from using students' rich experience as members of the college community and their knowledge about the culture of students on campus to provide concrete experience in order to allow students to develop a more abstract understanding of the process of research as a whole.

Students chose the research topics for the Study of Student Life unit. To help students choose a topic that would evoke engagement, the professor asked students to generate several ideas of interest to bring to class for consideration. Through class-wide discussions, the professor facilitated a focus-group style discussion regarding elements of interest regarding life on campus. Based on these extended discussions, the class voted for the topic of study to be pursued by the class as a whole over the course of the semester. This method both allowed the students to choose a topic in which they were personally interested and allowed the professor to moderate these selections to ensure a viable project. Some example topics that students have chosen over the years include an assessment of attitudes toward campus expansion, an examination of campus involvement and attachment to campus, an examination of student attitudes toward dining on campus, and a study of students' time-management skills. Subsequently, students developed and implemented a well-designed quantitative survey of the chosen topic and conducted a qualitative study related to the same topic. Though others have incorporated student research projects in their methods courses (Chapdelaine & Chapman, 1999; Marek, Christopher, & Walker, 2004; Singleton, 2007), we are unaware of other models that incorporate this level of student choice into the curriculum. Additionally, students choose which aspect of the project they will lead (including development of the survey, the analysis of the quantitative or qualitative data, or constructing the consent form and obtaining IRB approval; see Appendix). As a group, the students work together to develop the survey, evaluate the merits of the survey, make appropriate revisions, and administer the survey to a sample of students. As part of this project, students write a final report of their findings which, when appropriate, is submitted to relevant administrators or departments. It was anticipated that students learning through these methods

would directly perform those activities most relevant for direct professional development within the field (Kruger & Zechmeister, 2001).

In addition to conducting this classroom-wide study of student life, students in this course also completed an individual research proposal on a topic of their own and one that was of particular interest to them. Students were also encouraged to choose a research topic that had some professional or personal interest so that they might better sustain enthusiasm and interest in the topic. In order to maximize the extent to which students felt connected to their proposal topics, two class periods were devoted to library-based sessions in which the professor asked students to generate research questions directly related to their future professional goals or their current personal interests. In order to scaffold students' abilities to generate these questions, the professor engaged in one-on-one discussions about choosing the topic of the proposal, and students were reminded that the class was related to their abilities to excel in their post-collegiate lives. Research proposal were extensive and followed American Psychological Association guidelines including a title page, an abstract, an introduction, methods, proposed results and discussion, references, and appendices (when necessary and appropriate).

It is this mixture of laboratory-style research and individual development through the process of proposal construction that was hypothesized to effectively prepare students to begin their professional lives in the field. The combination of personal and group projects within the context of a research methods course, with a great degree of choice incorporated into both assignments, satisfies both the growing call to incorporate more active learning approaches (Stoloff, Curtis, Rodgers, Brewster, & McCarthy, 2012; Ryan & Deci, 2000) with a growing understanding that allowing students to build their own knowledge base results in deeper understanding of the material (Lawson & Wollmon, 2003). Further, the current study examined whether this curriculum was associated with an increase in students' knowledge of research methodology, their attitudes toward the research process and their professionally-related experiences.

Method

Participants

Participants were 47 students in a small Northeastern residential college campus. All participants were enrolled in a research methods course that was a requirement to fulfill the obligations of a psychology or human development major. Most students complete this research methods course after the Introduction to Psychology course and prior to completing the required Statistics course. This sequence of three classes provides the theoretical and practical foundation to the majors, and is required to proceed on to upper-level laboratory and capstone courses.

Measures

Knowledge of research methods. To test students' knowledge of research methodology, students completed an identical pre- and post-test consisting of 16 multiple-choice items. This test was based on one offered as a part of a free review service for students attempting to pass A-level exams in the United Kingdom (S-Cool, 2010). The measure was chosen because it was a standardized test that assessed a range of research understanding (e.g., "An experimental design in which the same participants are tested under different conditions is known as _____" and "Which of the following correlation coefficients could be interpreted as a strong positive correlation?"). This measure assessed general knowledge across a breadth of areas covered in psychology research methods and statistics courses, including experimental design, qualitative methodology, statistical understanding and correlational methods. The material covered in the course was presented from an unaffiliated textbook, and the classroom materials were developed by the instructor and unrelated to this standardized test. It was, therefore, considered a reasonable and objective assessment of students' knowledge of research methods in psychology.

Attitudes toward research. Attitudes toward research were assessed using an established, multidimensional measure of students' research-related attitudes (Papanastasiou, 2005). This 32-item measure evaluated students' perception of (a) the usefulness of research in helping them meet their own professional goals (e.g., "Research should be indispensable in my professional training"), (b) research anxiety (e.g., "Research makes me nervous"; "I feel insecure concerning the analysis of research data"), (c) positive attitudes towards research (e.g., "I like research"), (d) attitudes regarding relevance of research to life in general (e.g. "I use research in my daily life"), and (e) the difficulty of research (e.g., "Research is complicated"). Participants rated their agreement with these items on from a score of 1 (*strongly disagree*) to 7 (*strongly agree*), with negatively-worded items being appropriately reverse-coded. This overall assessment of attitudes toward research methodology contained high internal reliability at both the pre- and post-test assessment, Cronbach's a = .85 and .90, respectively.

Skill-based experiences. The third measure evaluated whether this curriculum for research methods advances students' professional skills. An academic skills inventory checklist assessed 10 broad skill sets as

important for students to develop during college (Kruger & Zechmeister, 2001). The measure includes items to assess whether students engage in activities related to interpersonal and counseling skills, behavioral management or teaching skills, experiences working with special populations or understanding individual differences, and critical thinking or problem solving skills. Additionally, the assessment includes items in which students check off whether they have engaged in activities that (a) build communication skills (e.g., "I have made at least 3 oral presentations in a classroom"), (b) build information gathering skills (e.g., "I have read 3 articles in a scientific or professional journal"), (c) help them learn to work effectively in teams (e.g., "I have worked in a group project for class"), (d) deepen their knowledge of research methods and statistics (e.g., "I have helped conduct a research project in the natural or social sciences"), (e) understand best ethical practices in the field (e.g., "I have discussed whether a research project was ethical or unethical"), and (f) develop technology-related experiences (e.g., "I have created a multimedia presentation using computer software").

Procedure

Assessment of the three outcomes was completed at the beginning and end of the semesters. On the first day of class, an individual who was not an instructor of the course and had no prior knowledge regarding the purpose of the study administered the consent forms and measures. On the last day of class, someone naïve to the study asked students to complete the same body of measures to assess any changes in research knowledge, skills, or attitudes made over the course of the semester. This post-assessment timing occurred before the finals period. The college Institutional Review Board approved these procedures prior to data collection.

Throughout the semester, students completed two large projects; one was group-based and the other individually developed. The Study of Student Life was a semester-long project that began with the class collectively deciding which aspect of student life they would like to investigate. Students signed up for groups, and they were assigned to complete all of the tasks described previously (see Appendix). The second major project, the development of a research proposal, was completed by the student individually and was based on a student-chosen topic of interest. It was completed in sections throughout the course of the semester.

Results

Using paired-samples t tests, we first examined whether students' knowledge, attitudes, and reported skill-based experiences had significantly changed

between the beginning and end of the course. Subsequently, we performed a series of correlational analyses to investigate the extent to which activities, knowledge, and attitudes measured prior to the course and then subsequent to the course—or the differences between the two assessments—were related to one another.

Changes in Student Knowledge, Attitudes, and Skills-Experience Activities

As can be seen in Table 1, students made significant gains in their knowledge of research methods, as assessed through an independent measure, unrelated to the text-book or classroom-based materials. Students' attitudes toward research were also significantly higher at the end of the course compared with their attitudes at the beginning of the course. Even during the pre-course assessment, students in this sample held globally neutral to positive views of research. Prior to the course, students responded with an average of 4.46 on the research attitudes measure, above the mid-point of the scale. At the end of the course, students reported a mean of 4.66 on the same scale, representing a slight, but significant increase in students' attitudes toward the research process, $t(46) = 2.41$, $p < .05$.

Over the course of the semester, students also reported significant gains in their professional experiences, particularly those related to the topic of research methods and others directly addressed by the content and activities of the course. We first examined whether students' reported overall levels of skill-based experience had changed between the beginning and end of the course. At the beginning of the course, students indicated that they had engaged in approximately 39 of the 60 activities, and by the end of the course, students reported they had engaged in an average of 48 of these, $t(46) = 7.04$, $p < .001$. As can also be seen in Table 1, the areas in which students made the most professional progress were written and oral communication, information gathering, group work, research methodology, and professional ethics—those content areas most directly addressed during the course of the semester.

Correlations Between Student Knowledge, Attitudes, and Experiences

A series of correlations were calculated to determine whether students' characteristics prior to taking the course predicted the changes they made during the semester or their characteristics at the end of the course (see Table 2). We also calculated whether students held toward research prior to taking the course were completely unrelated to their scores on the

Table 1
t *Tests Indicating Change from Pre-Course to Post-Course Scores, Attitudes, and Skills*

	Pre-course measurement M (SD)	Post-course measurement M (SD)	Paired difference at post-course M (SD)	*Paired Sample* t test
Knowledge of Research	7.81(2.17)	10.11 (2.03)	2.30 (2.30)	$t(46) = 6.84$***
Attitudes toward Research	4.46 (0.58)	4.66 (0.67)	0.21 (0.59)	$t(46) = 2.41$*
Total Skill-based Experiences	38.65 (10.12)	48.19 (10.36)	9.54 (9.29)	$t(46) = 7.04$***
Written and Oral Communication	3.81 (1.38)	4.49 (1.23)	0.68 (1.35)	$t(46) = 3.45$**
Information Gathering	4.79 (1.65)	7.04 (1.12)	2.26 (2.04)	$t(46) = 7.59$***
Groups/Organization/Community	4.55 (1.69)	5.38 (1.64)	0.83 (1.65)	$t(46) = 3.45$**
Interpersonal/Counseling	3.23 (1.51)	3.96 (1.73)	0.72 (1.78)	$t(46) = 2.79$**
Behavior Management/Supervision/ Teaching	3.55 (1.97)	3.85 (2.00)	0.30 (1.77)	$t(46) = 1.16$
Individual Differences	4.34 (1.83)	4.65 (1.78)	0.32 (1.59)	$t(46) = 1.38$
Critical thinking/Problem Solving	3.25 (1.75)	3.57 (2.22)	0.32 (2.15)	$t(46) = 1.00$
Research Methodology/Statistics	2.07 (2.03)	4.13 (2.28)	2.07 (2.44)	$t(46) = 5.73$***
Ethics/Values	3.17 (1.89)	4.98 (2.19)	1.80 (2.25)	$t(46) = 5.45$***
Technology/Computer	6.02 (1.77)	6.54 (1.72)	0.52 (1.77)	$t(46) = 2.00$+

Note. $N = 47$ individuals.
+$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 2
Correlations Between Research Knowledge, Research Attitudes, and Skill-Based Experiences from Pre- to Post-Course Assessment

	1	2	3	4	5	6	7	8	9
1. Pre-course research knowledge									
2. Post-course research knowledge	.40**								
3. Change in research knowledge	-.59***	.50***							
4. Pre-course research attitudes	.25+	-.02	-.26+						
5. Post-course research attitudes	.03	.22	.17	.57***					
6. Change in research attitudes	-.22	.27+	.45**	-.34*	.58***				
7. Pre-course skill-based experiences	.44**	.42**	-.04	.33*	.30*	.02			
8. Post-course skill-based experiences	.39**	.55***	.13	.24	.44**	.26+	.59***		
9. Change in skill-based experiences	-.05	.16	.19	-.09	.16	.27+	-.43**	.47**	

Note. $N = 47$ individuals.
+$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

increases in one domain (e.g., research knowledge) were associated with increases in another domain (e.g., research attitudes). Change over the semester was computed by subtracting students' pre-course assessment from their post-course assessment scores.

Prior to taking the course, students' knowledge of research methods was positively related to the number of skill-based experiences in which they had engaged and marginally related to their attitudes toward research, $r = .44$ and .25, respectively. The attitudes

research knowledge test at the post-course assessment ($r = -.02$), indicating that students who already held more positive attitudes toward research did not achieve higher knowledge scores at the semester's end. Indeed, those students who scored lower on the research attitudes scale at the beginning of the course made marginally more gains in knowledge over the course of the semester ($r = -.26$), perhaps because, prior to the course, they had been completely unfamiliar with both the goals or the process of research. Additionally, students' knowledge of research prior to taking the course was not related to either their research attitudes at the end of the course or to the changes in these attitudes over the course of the semester. In other words, students who knew more about research at the beginning of the course had marginally more positive attitudes at the beginning of the course, but these pre-course differences among students disappeared by the end of the course.

The overall number of students' skill-based experiences was associated with research-based knowledge both at the beginning of the semester and at the end of the semester, $r = .44$ and $.55$, respectively. Increases in the number of professional, skill-based experiences was marginally related to an increase in attitudes toward research, but these changes in professional experiences were unrelated to changes in knowledge of research. By the end of the course, students' attitudes toward research were positively related to their overall number of skill-based experiences, $r = .44$.

Discussion

The current research examined whether this curriculum which involved a great deal of student choice along with two research activities mirroring those that occur for professional researchers promoted knowledge, improved attitudes toward research and provided a forum for students to gain important experiences. Findings from the current study suggest that this combination of a campus-life group research project and individual proposal development is associated with increases in students' knowledge of research methodology, positive attitudes toward research, and the number of professional experiences gained during college. This combination may significantly enhance their expertise in the field relatively early in their academic careers, thus better preparing them for subsequent courses (Freng et al., 2011). The current study also elucidated the ways in which student characteristics are interrelated both before and after taking a research methods course.

These results indicate that learning research methods by engaging in research activities is associated with increased positive perceptions of research, but the current findings extend previous research by examining students' responses to a curriculum in which a broad range of student choice has been introduced. These findings are consistent with those that have found that this active learning approach in research and quantitative methodology is associated with positive attitudes among students (Harlow, Burkholder, Morrow, 2002; Marek et al., 2004). An examination of the pre-course student characteristics and their correlations with post-course student characteristics suggests that this kind of approach to teaching is effective for a broad range of students. We examined whether students who came into the course with more positive attitudes toward research finished the course with more knowledge of research, but this was not the case. Pre-course attitudes toward research were unrelated to the post-course level of research knowledge. This suggests that an active learning approach, in which students are afforded a range of opportunities to pursue research topics that are personally meaningful, is an effective pedagogical approach, even when students enter the course with relatively less positive attitudes toward the process of research. When learning new information, learners are better able to recall it later when it has been encoded using some kind of reference to the self, perhaps because it allows for richer elaboration of the new material or perhaps because it aids in the organization of the new material, or perhaps because of some combination of the two (Klein, 2012).

These results converge with Ciarocco et al. (2013), who demonstrated more positive attitudes towards research associated with active-learning pedagogical strategies; however, their findings are in contrast to other research conducted by Sizemore and Lewandowski (2009) who found that learning more about research methodology reduced student's positive attitudes toward the process. These authors suggested that this reduction may have arisen because, after taking a research course, students may have experienced a disconnection between their enhanced understanding of methodology and their ability to directly apply these skills to their personal or professional goals. The current study, however, reveals that a boost in attitudes toward research is also attainable with activities that are personally relevant to the student. In this sense, the current study extends findings beyond previous research discussed earlier and suggests these gains are possible under conditions which provide extensive opportunities for student autonomy within the context of concrete learning experiences. Consistent with the theory of levels of processing (Craik & Tulving, 1975), this type of learning should foster long-term retention of the material. Follow-up research should focus on the possible future

benefits of these different types of strategies. The choice-driven curriculum described in the current study may offer a way to help facilitate student's connection between understanding research methodology and their personal goals, and thus may also be responsible for students' maintained and enhanced attitudes toward the benefits and usefulness of research.

As part of this project, students work together to write a report of their findings, which can be submitted to the appropriate administrators or department. As a group, students interpret their findings and strategize about the best way to present them. This final stage of the proposed project provides an opportunity for students to appreciate the power of the social sciences and the implementation of good critical thinking skills. After completing this project, students are also in a better position to evaluate the findings of the studies they encounter in peer-reviewed articles. It is this kind of understanding which will allow them to translate specific concepts to a range of situations in their future work as students and in their professional lives.

Just as Singleton (2007) observed, throughout the semester, the Study of Student Life provides a foundation for a concrete discussion of the costs, benefits, opportunities, and struggles with data collection. For example, when students work together to develop a survey that will be distributed to their fellow students, they confront the challenges associated with construct development and the operational definition of a specific, delineated idea. When we discuss what "campus involvement" entails, students begin to comprehend that this is a multi-dimensional idea, which requires clear, sharp language to assess reliably.

Students also gain an awareness of the underlying reasons some methodologies are chosen by researchers and described in the literature. Because students are allowed to choose which kind of sampling method they use to gather quantitative data, we discuss the benefits and detriments of using a convenience sample versus a random sample. Faced with obtaining a sampling frame from the registrar's office and being required to obtain 10 participants from either people they know on campus or strangers that they must contact, students understand why much research relies on a convenience rather than a representative sample. They also understand that they have limited the impact the survey can have on the policies of the school. If they cannot assert that the findings are representative of the campus as a whole, they come to realize that administrators are less likely to rely on their findings to shape campus practices. Another benefit of this approach to teaching methods is student-led discussion of the implications of their findings. Typically, students assume that the majority of other students will agree with their opinions regarding campus life, but both the quantitative and qualitative data often indicate that, generally, other members of the student

community hold more moderate views than was hypothesized. Moreover, they appreciate the powerful combination of qualitative and quantitative research in understanding the complexity of a phenomenon. This provides an important lesson for students regarding the value of systematic research in contrast to personal assumptions and conjecture.

In addition to allowing students to build their understanding of research methodology while improving their attitudes toward research, this curriculum was associated with an increase in professional, skill-based experiences across several domains, including communication, information gathering, and working effectively with groups. This approach to teaching methods is consistent with other research that suggests successful undergraduate programs allow students to engage in experiential learning and also connect their understanding of curriculum-based principles to the solution of "personal, social, and organizational problems" (Stoloff et al., 2012, p. 91). Experience-based opportunities, which allow students to become proficient, may be particularly valuable as they leave their undergraduate institutional lives and enter the field as professionals or graduate students. Some have argued that a skills-based curriculum vita can be particularly advantageous to students as they pursue their post-collegiate careers (Kruger & Zechmeister, 2001; Stoloff et al., 2012). This kind of assessment can provide benefits to individual students, but it can also provide benefits to all members of the department. For example, this evaluation of students' professional development can promote an understanding of departmental strengths as well as identify areas that should be expanded to provide a richer student experience throughout their academic trajectories (Stoloff et al., 2012).

While the group study on campus life clearly has benefits for the class and the individuals as a whole, the research proposal really allows students to entertain their personal intellectual curiosities about research. Because students are encouraged to and supported in the process of choosing a topic consistent with their professional goals, they often become more involved with the process of writing a research proposal. During several course sessions, they are given an opportunity to explain their proposal goals and potential methods to others in the course, and these opportunities also provide students with a forum in which they can engage in activities in a way that is consistent with those more advanced in the profession.

Limitations

Certainly there are important limitations to the current study. Perhaps most significant is the lack of a control group to which student growth in these arenas might be reasonably compared. Given the needs of the

students, it was not possible to find another research methodology course engaged in a contrasting curriculum to which changes in students' knowledge, attitudes and experiences could be compared prior and subsequent to the course. Other limitations relate to the interpretation of these findings. While the degree of student choice is theoretically related to an increase in the positive attitudes students had toward the process of research (Ryan & Deci, 2000), we have not empirically identified these meditational variables. Future research should incorporate assessments of student's changes in their levels of intrinsic motivation for understanding research methodology as a function of taking this kind of course (Jang, 2008). Moreover, findings from the current study make it impossible to disentangle effects associated with the group study of student life activities from those involved with the individual assignments associated with the development of a grant proposal. Finally, the test of knowledge gains that we incorporated into the present study included four statistics-related concepts, a topic which was not specifically targeted within the course, but mentioned only in connection with other content. In fact, students may dread their statistical methodology course even more than the other research methodology courses they take (Onwuegbuzie & Wilson, 2003). Future studies of research methodology courses, *per se*, should include measures that separate these two subject matters to test knowledge gains.

Conclusion

Despite these limitations, findings from the current study lend support to the growing body of literature which suggests that students learn best when they actively engaged in the process (Stoloff et al., 2012) and are most intrinsically motivated when they feel they have autonomy over their learning (Jang, 2008; Ryan & Deci, 2000; Vansteenkiste et al., 2004). By teaching research methods in this way, students engage in many of the same processes that researchers do as they collect and analyze data. The practical challenges researchers confront through the research process or through working out the details of proposing a new one often precipitate a greater understanding of not only the topic they are studying but also of research design more generally. To build an abstract understanding of the necessary concepts, students must also have an opportunity to engage directly in the research process. Students who take part in this direct practice have an opportunity to translate information learned in the classroom into a more personal and deeper knowledge base that they can carry forward into other courses as well as their professional lives after college.

Findings from the current study may extend beyond research methods courses, however. We hope that the motivating force behind these results is grounded in collaborative learning and student choice. Therefore, professors teaching a range of courses across many disciplines can provide some range of choice in their assignments and class interactions to enhance students' sense of autonomy in their learning. To further develop students' connections to course content, professors might provide assignments that prompt students to reflect on ways in which the material covered in the course is related to the other academic pursuits or challenges they face in their personal lives. Other projects might ask students to make explicit connections between the content of the course and their future professional lives. Finally, whenever possible, professors may provide their students with authentic tasks that help them to make concrete connections between the material of the course and the ways in which these concepts are enacted in the world. To summarize, the results of the current research can be generalized across several disciplines as long as assignments involve a level of student choice and collaborative learning (Ambrose, Bridges, DiPietro, Lovett, & Norman, 2010).

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Acknowledgments

Appendix
Sample Outline for Study of Student Life Group Descriptions

Student Life Study: Description of Group Papers and Presentations
(Handout to students)

Student Life Study Presentation & Paper: The Student Life Study will be conducted by the class as a whole throughout the semester. Findings from the study will be presented by the class to the appropriate members of the faculty, student, staff, and/or administration. Through this unit, students will develop a well-designed quantitative survey and qualitative study of some aspect of student life. The class will choose a topic to investigate together. Students will work together to develop the research questions, the hypotheses, the survey, evaluate the merits of the survey, make appropriate revisions, administer the survey to a sample, and present findings. In addition, each member of the class will make naturalistic observations and the analysis of those will take place as a class. There will be 5 group projects associated with this unit. Please choose one aspect of this and work together with other students to write the appropriate materials. Each group will then present its part of the study to the other members of the class and receive feedback. Please take this feedback and make the necessary revisions before turning in the final, written product (sometime the next week). Each group will be graded on the content and clarity of the presentation, the incorporation of comments by peers in the class, and the content of its written work.

Institutional Review Board (IRB) application, Consent Form, & Introduction: Members of the IRB application, consent form, and Intro group will be responsible for completing the IRB application and submitting it to the IRB Committee. In addition, the two members of this group will design appropriate consent forms which will be used as part of the Survey. Finally, this group will write the overall introduction for the study. This introduction will include an abstract and two double-spaced written pages detailing the research questions and the methods used for the investigation (both the survey and the naturalistic observations). The paper and presentation for this group will include two consent forms (one for the quantitative study and one for the qualitative study), the completed IRB form, and the introduction (an outline should be presented before the actual written text). The paper should follow APA formatting guidelines.

Survey Questionnaire Design: The members of the Survey Design Group will use Survey Monkey or Google Forms to construct the questionnaire administered to members of the Student community. Based on the research questions, hypotheses, and questionnaire items developed by the class as a whole, the members of this group will develop a questionnaire that will include a set of directions to participants. The presentation for this group will largely consist of the formatted questionnaire. A second presentation will be shorter and incorporate all feedback from the class. Members of this group will also write the Method section of the final report that should be two written pages of text (and should follow APA guidelines). The methods section will include details about the questions and procedures for the study.

Qualitative Write-Up: The members of the Qualitative Group will be responsible for analyzing and presenting the qualitative portion of the Study of Student Life. Data from this study will include the naturalistic observations conducted by the entire class. In addition, the members of this group will perform eight intensive interviews with participants (each member of the group will conduct two of these interviews). Members of this group should work together to write a four-page double-spaced paper that includes their interpretation of the data supported by quotes from participants and quotes from the field notes generated by the naturalistic observations. In addition, the members of this group should include three conclusions based on their interpretations of the data. The presentation to the class should include data (holding the participants' personal information confidential) and an analysis of the data. In this case the data will include the quotes from participants' interviews and field observations.

Quantitative Write-Up: Members of the Quantitative group will be responsible for presenting the data gathered though the online survey. The quantitative paper should be four to five double spaced pages long and include a participants section with a complete description of the demographic characteristics of the sample. In addition, this paper should include the interpretations of the quantitative results. Based on the research questions, the hypotheses of the study and through class discussions, a series of analyses will be generated (the professor will perform the statistical analysis and provide the group with the overall results). This section should also include 1 to 3 tables

and/or figures portraying the findings. The presentation of the quantitative findings should include an outline, the sample section, the results sections, and the figures and tables for the study.

Integration of Final Report: Members of the Integration Group will work together to compile all of the materials generated by the other four groups of students. As part of their work, the two members of this group will write a two-page discussion section that presents the final conclusions of the investigation. In addition, members of this group will integrate the introduction, methods, quantitative, and qualitative reports. The presentation for this group will include an outline of the overall report.

Building a Community of Inquiry and Analytical
Skills in an Online History Course

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The purpose of this case study was to assess a history instructor's attempt to redesign an introductory history survey course. Traditionally, it has been taught in a face-to-face environment within the university's core curriculum program. It was redesigned as a synchronous online course that provided students with opportunities to work collaboratively to build a community of inquiry and to develop the analytical skills needed to understand course materials and compete in the 21st-century workforce. Students were required to attend daily 100-minute web conferencing sessions consisting of mini-lectures, polling questions and discussions in large and small groups (i.e., "breakout rooms"). Daily quizzes were introduced to incentivize students to complete the assigned readings and help them prepare to contribute meaningfully to group discussions, as well as to allow the instructor to assess student understanding objectively. Students completed a modified Community of Inquiry Survey at the end of the course. Results showed that the instructor was able to build a strong level of community of inquiry, teaching presence, social presence, and cognitive presence.

The purpose of this case study was to assess a history instructor's attempt to redesign an introductory history course from a face-to-face class to a distance education class that included high levels of community of inquiry and analytical skills.

Literature Review

Lecture-based instruction has traditionally been the preferred mode of pedagogy for college-level introductory history surveys in the United States and elsewhere (Trinkle, 1999). In this mode, the instructor's role is to present historical content, ideally in a way that models critical thinking and stimulates the same in the students. The student's role is to take notes on the information presented, ideally in a way that captures the instructor's key arguments, and assesses the cogency of those arguments in relation to the evidence marshaled. In theory, the pedagogy incorporates opportunities for students to develop critical thinking skills. In reality, because many of the students taking such courses are not skilled note-takers, their lecture notes, when they make an effort to take them, are often far from ideal. From a student's perspective, lecture-based instruction can make history appear to be little more than a concatenation of facts to be memorized, "a stream of names and dates unrelated to their own lives" (Edmonds, Hull, Janik, & Rylance, 2005, p. 4). The passive learning that characterizes lecture-based instruction can make it difficult for students to develop the analytical skills necessary for understanding historical (and other) subject matter (Mader, 2012). Indeed, citing recent research, Butin (2010) argued that "traditional didactic, lecture-based instruction is the worst form of instruction for the vast majority of our students and for most types of content" (p. 45). It seems clear, however, that history instructors are increasingly turning away from lecture-based instruction and toward modes of pedagogy that enhance student learning by emphasizing their active participation in assignments and in-class exercises designed to help them develop critical thinking and effective communication skills (Mader, 2012). Such activities can include (a) evaluating sources, (b) identifying key passages in documents, (c) identifying underlying assumptions, (d) identifying points of view, (e) evaluating reasoning and logic, (f) evaluating inferences, (g) evaluating evidence, (h) assessing completeness, (i) articulating implications, and (j) taking a stand (Edmonds et al., 2005). Instead of the passive learning that characterizes lecture-based instruction, courses that force students to work collaboratively with the instructor and their peers to make meaning of course content promise to make students active learners and help them develop the skills they need to succeed in the classroom and compete for jobs in the 21st century.

Critics of higher education in the United States claim that many students are failing to develop higher-order cognitive skills such as critical thinking and complex reasoning because they are too focused on content coverage (Arum & Roksa, 2011; Paul, 1992). This type of learning, the argument goes, fails to prepare students to enter the 21st century workforce, where employers place greater value on the ability of employees to analyze (as opposed to memorize) data, work collaboratively, and communicate effectively (Bissonnette, 2010; Garrison & Anderson, 2003; Sternberg, 2013; Summers, 2012). A survey of employers by Hart Research Associates (2012) found that 93% of them agreed that "a candidate's demonstrated capacity to think critically, communicate clearly, and solve complex problems is more important than their undergraduate major" (p. 1). Scriven and Paul (1987) defined critical thinking as "the intellectually

disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action" (para. 2). In light of these considerations, and recognizing that most students enrolled in introductory history courses are not history majors, the university history teacher would be well advised to design courses that help students develop transferable skills that will serve them in other majors and in the workforce.

Research on teaching and learning in higher education indicates several limitations of lecture-based instruction. The lecture format stimulates students' lower centers of the brain (sometimes referred to as the "mindless" brain centers), and many students are unable to sustain focus in lecture for more than ten to 15 minutes in any case (Bligh, 2000; Penner, 1994). Lecture-based instruction typically provides few, if any, opportunities for students to work collaboratively with both instructor and peers to make meaning of course materials and to develop their analytical and communication skills (Organization of Economic Cooperation and Development, 2009). Indeed, one study has found that faculty in higher education speak 86% of the time in class (Brown & Atkins, 1988). Yet, despite the inherent limitations of lecturing, lecture-based instruction continues to predominate in most colleges and universities in the United States. If students are to develop the skills they need to succeed in all their courses and to compete on the increasingly competitive global job market, they need to be given more opportunities to engage actively with course materials and to work collaboratively with peers (Kolb & Fry, 1975). This means that instructors need to do more to design courses that are learner-centered (as opposed to instructor-centered), and create a community of inquiry where students are made chiefly responsible for making sense of course materials in the classroom, whether in a face-to-face or online learning environment.

Collaborative learning contributes to building a community of inquiry and helps students develop their analytical and communication skills by requiring them to respond to the instructor and each other during group discussions (Bailin, Case, Coombs, & Daniels, 1999; Thayer-Bacon, 2000). The concept of knowledge formation by a community of inquiry was first introduced by educational philosophers Charles Sanders Peirce (1877) and John Dewey (1902). In a community of inquiry, knowledge is considered to be fluid and complex, involving overlapping disciplines, and therefore requiring interaction between a community of learners and an instructor or facilitator to guide group work and to help the community of learners form new levels of understanding. A classroom engaged in authentic inquiry leads to "questioning, reasoning, connecting, deliberating, challenging, and developing problem-solving techniques" (Lipman, 2003, pp. 20-21). Garrison and Anderson (2003) defined a community of inquiry as a group "composed of teachers and students transacting with the specific purposes of facilitating, constructing, and validating understanding, and of developing capabilities that will lead to further learning" (p. 23).

Scholars have applied the concept of community of inquiry to online learning when examining the use of computer-mediated communication in an educational experience (Garrison, Anderson, & Archer, 2000). When initially developed, online classes were designed using asynchronous technologies allowing students to access course material at any time and from any number of places. This gave students increased independence, but it also meant increased isolation and, often, a loss of opportunities for collaborative learning. Independence and collaboration seemed contradictions (Garrison & Anderson, 2003). Because collaboration in online classes does not happen spontaneously, the instructor must intentionally design online courses to include assignments and exercises that require students to work together to develop a strong level of community of inquiry. Researchers have demonstrated that online classes can be designed to achieve high levels of community of inquiry by incorporating assignments and exercises designed to promote communication and collaboration among learners (Garrison et al., 2000). It is important for students to have frequent opportunities to interact with their intellectual community to enhance their knowledge construction (Vygotsky, 1962). The three types of interactions that are critical to students' intellectual development are learner-content, learner-instruction, and learner-learner interactions (Moore, 1989). Advances in newly developing Web 2.0 technologies such as web conferencing now allow instructors to include more activities that help to improve interactions between geographically separated participants in distance education classes (Hwee Ling, 2007).

The three elements that make up community of inquiry are (a) cognitive presence, (b) social presence, and (c) teaching presence. *Cognitive presence* has been defined as "the extent to which learners are able to construct and confirm meaning through sustained reflection and discourse in a critical community of inquiry" (Garrison, Anderson, & Archer, 2001, p. 5). *Social presence* can be defined as an individual's ability to project themselves into the community of inquiry and be perceived as a "real" person (Gunawardena & Zittle, 1997). *Teaching presence* has been defined as "the design, facilitation, and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile learning

outcomes" (Anderson, Rourke, Garrison, & Archer, 2001). In an online environment, a community of inquiry does not naturally occur and must be intentionally designed into the course. Students often have few, if any, opportunities to speak to each other, and opportunities to discuss course materials are often perfunctory and otherwise circumscribed. In order to build a community of inquiry in an online environment, the instructor must design assignments requiring meaningful and relevant interaction between the instructor and students on one hand and, on the other, among students.

Research Question

The present study assessed one university history instructor's attempt to redesign and deploy an introductory European history course, taught every semester in multiple sections by several faculty in a face-to-face classroom, to a synchronous online environment via web conferencing during an abbreviated summer term. The purpose of the study was to investigate if it is possible to achieve high levels of community of inquiry, social presence, teaching presence, and cognitive presence in an online introductory history course.

Methodology

Course Design

The new online course, The West and the World Since 1500 (HST 1200), was taught through the university's learning management system (LMS). The course required students to participate actively in daily 100-minute meetings using web conferencing technology. The meetings combined the instructor's live audio narration (approximately 5 minutes) of individual PowerPoint slides with polling activities and large- and small-group discussion of course materials. In addition to the instructor's slides and audio narration, the materials included an electronic history textbook, additional primary source readings posted on Pilot (the university's learning management software), and brief videos related to course themes. Students were required to have high speed Internet access and to use a USB noise cancelling headset with microphone for the purpose of being able to participate in discussions during the meetings.

The instructor faced several instructional challenges in achieving course objectives. First, most students enrolled in the course to fulfill a core curriculum requirement. In the instructor's experience, students often have limited enthusiasm for their core courses and as a result can be disengaged in the classroom—virtual or otherwise. Often students in such courses do not complete the assigned readings or so not consistently attend class meetings, making it difficult, if not impossible, for students to contribute meaningfully to discussions (Rae, 2011). Core courses also tend to have lower completion rates than courses offered within students' majors. A second instructional challenge was the need to design a course traditionally taught during a 16-week semester for an abbreviated 6-week summer term. A third challenge was to design a course that required students to interact in meaningful ways in an online virtual classroom.

The instructor made several course design decisions intended to mitigate these challenges. During the first meeting, the instructor and students together reviewed a detailed syllabus outlining course objectives and requirements, and indicating the assignments to be completed prior to each class meeting. Students were required to take an online syllabus quiz prior to the second meeting to validate their agreement and understanding of course policies and strategies. To encourage student engagement, the instructor made attendance and active participation in the daily meetings a requirement of the course, with participation counting for 25% of the final grade. Because the live sessions were recorded, students who chose not to attend them could earn participation points by posting a "missed class summary" on Pilot. (In practice, a student who missed the daily meeting rarely took advantage of this opportunity.) An undergraduate supplemental instruction leader was hired to help the instructor track student participation during the meetings.

To help students focus their reading and prepare for group discussions, the instructor posted "focus questions" in the course LMS and identification terms tied to the assigned readings and other materials. In addition, the instructor incorporated daily reading quizzes, tied to the focus questions and identifications, to be completed prior to each meeting, as well as a quiz at the end of the week to assess student understanding of the materials discussed during the meetings. The 10-question objective quizzes were administered electronically via Pilot; students were given 15 minutes to complete each quiz, which they could take twice, with the highest score counting as the final quiz grade. The quizzes counted for 50% of the final grade. A final exam consisting of objective questions counted for the remaining 25% of the final grade.

Thanks to web conferencing technology, there were many ways for students to participate in the live sessions. In fact, the virtual classroom combined many of the features of a face-to-face learning environment with additional e-learning tools such as instant messaging, polling questions, emoticons, audio and video interactions, application sharing, web touring, and breakout rooms. Based on research suggesting that "planning and facilitating frequent and relevant

[participant] interactions is the single most important thing [moderators] can do to create effective virtual classroom sessions" (Clark & Kwinn, 2007, p. 10), the instructor sought to minimize the time spent lecturing and maximize interactions with and among students. During meetings, the instructor used the "talk" tool to provide audio narration of PowerPoint slides uploaded onto the whiteboard, and to ask students to respond to questions via microphone or instant messaging. Students who joined the web conferencing sessions had their names indicated on the "participant panel," and they were able to use the "raised hand" tool to indicate a desire to ask or answer questions. This allowed the instructor to call on students by name. Students who for various reasons might be disinclined to use the talk tool to respond to the instructor's prompts could use instant messaging to participate. Another way students participated was by responding to polling questions projected onto the whiteboard. Student responses were anonymous (to other students but not to the instructor), and the group's collective response could be projected onto the whiteboard as a graph; which could then be used for debriefing and to prompt further discussion.

Research studies have shown that deep learning can be achieved by working collaboratively in small groups more effectively than by learning individually (Clark & Mayer, 2003; Jonassen, Lee, Yang, & Laffey, 2005). With this in mind, the instructor used the breakout rooms to facilitate peer discussion of course materials in groups of four to five students. Web conferencing technology allowed the instructor to assign particular students to particular groups, or to assign students randomly to groups. When prompted, students were able to move themselves to a breakout room by electronically dragging their names to the room using the "breakout room" tool. In breakout rooms, students were given an allotted amount of time (usually 5-7 minutes) to discuss questions or prompts on a slide sent to the room by the instructor. The prompts were typically taken from the assigned focus questions and usually involved analysis of primary sources. Students were asked to evaluate the sources in terms of provenance, reliability, and credibility; to identify key passages and underlying assumptions; to evaluate the reasoning and logic of arguments in relation to the evidence marshaled; and to take a stand on a "fighting question" posed by the instructor. Because these questions were open-ended, there was ample opportunity for students to develop critical thinking skills. Students were able to write and otherwise create content on the slides. Sometimes students were asked to choose a spokesperson for the purpose of debriefing on returning to the main room. Meantime, the instructor and supplemental instruction leader were able to move electronically among the breakout "rooms," sometimes encouraging participation and guiding the discussion, sometimes simply recording student observations and questions.

Participants

The students in this research study were enrolled at a mid-sized university located in the Midwest. Although 55 students originally enrolled in the course, only 19 were enrolled after the drop date. Of the 19 students who remained enrolled in the course, 15 completed a post-course survey. Permission to conduct the survey was requested and granted by the Community of Inquiry survey author and the Institutional Review Board at the university. The survey was created in Qualtrics, an online survey tool. A link to the electronic survey was emailed to undergraduate students through their LMS during the final week of the course. The researcher that sent the link to the undergraduate students was someone other than the course instructor.

Survey

A 34-question community of inquiry (CoI) survey was developed to measure the levels of teaching presence (TP), social presence (SP), and cognitive presence (CP) from students' perspectives (Swan et al., 2008). The CoI survey includes three subscales with the first 13 questions measuring TP, the next nine questions measuring SP, and the last twelve questions measuring CP (e.g., "The instructor clearly communicated important course topics"). The students were asked to respond using a Likert scale from 1 (*strongly disagree*) to 5 (*strongly agree*). The survey has shown strong internal consistency with Cronbach's alphas of .96 for TP, .92 for SP, and .95 for CP (Diaz, Swan, Ice, & Kupczynski, 2010), indicating that the reliability of the CoI survey is high. Three open-ended survey questions were added to the CoI and used to gain additional insight from the participants. Five of the questions on the CoI included minor modifications suitable for the classes using web conferencing, with the phrase "web conferencing" substituting "online medium" or "course discussion." See Appendix for a copy of the survey and open-ended questions.

Results

The mean response for the CoI scales ranged from 3.21 to 4.94 (overall $M = 4.07$, $SD = 0.55$). Cronbach's alphas in the present study yielded high internal consistencies of .94 for CoI. Following are results for the three subscales (TP, SP, and CP) and the open-ended items.

TP, SP, and CP Subscales

The subscale for TP was measured in the first 13 questions of the CoI survey (see Table 1). The mean

response for TP ranged from 2.77 to 5.00 (overall $M = 4.14$, $SD = 0.67$). The Cronbach's alpha for TP was .90, indicating a high level of internal consistency. The subscale for SP was measured with questions 14 through 22 of the CoI survey (see Table 2). The mean response for SP ranged from 3.00 to 5.00 (overall $M = 4.10$, $SD = 0.64$). The Cronbach's alpha for SP was .90, indicating a high level of internal consistency. The subscale for CP is measured in questions 23 through 34 of the CoI survey (see Table 3). The mean response for CP ranged from 2.83 to 5.00 (overall $M = 3.97$, $SD = 0.61$). The Cronbach's alpha for CP was .91, indicating a high level of internal consistency.

Open-Ended Comments

Students were asked to provide open-ended comments to three questions at the end of the CoI survey. Students were asked to comment on the merits and shortcomings of course design in terms of

opportunities to work collaboratively to develop a deeper understanding of course content. They were also asked to suggest ways to improve the course in terms of the same opportunities. A total of 11 students responded to the open-ended questions. The authors of the present study reviewed the comments and grouped them into four categories.

The first category comprises comments attesting to students' positive level of satisfaction with the course and/or instructor ($n = 5$). Examples include, "The class participation made it enjoyable"; "It was good"; "The professor was pretty good at explaining the material"; "[The instructor] has it down pat. I come from a long line of teachers and know what to expect in a class environment"; and, "I'm truly satisfied with my experience this course. I learned a lot."

The second category comprises comments indicating that the course design made it possible for participants to work together to make sense of course materials ($n = 3$). Examples include, "The group will

Table 1
CoI Survey Questions Measuring Teaching Presence

Question	N	Scale 1	2	3	4	5	M (SD)
The instructor clearly communicated important course topics.	15	1 6.7%	1 6.7%	1 6.7%	6 40.0%	6 40.0%	4.00 (1.20)
The instructor clearly communicated important course goals.	15	1 6.7%		1 6.7%	7 46.7%	6 40.0%	4.13 (1.06)
The instructor provided clear instructions on how to participate in course learning activities.	15	1 6.7%	1 6.7%	1 6.7%	5 33.3%	7 46.7%	4.07 (1.22)
The instructor clearly communicated important due dates/time frames for learning activities.	15	2 13.3%		1 6.7%	4 26.7%	8 53.3%	4.07 (1.39)
The instructor was helpful in identifying areas of agreement and disagreement on course topics that helped me to learn.	15		2 13.3%	1 6.7%	4 26.7%	8 53.3%	4.20 (1.08)
The instructor was helpful in guiding the class towards understanding course topics in a way that helped me clarify my thinking.	15			1 6.7%	6 40.0%	8 53.3%	4.47 (0.64)
The instructor helped to keep course participants engaged and participating in productive dialogue.	14	1 6.7%		1 6.7%	6 40.0%	6 40.0%	4.14 (1.10)
The instructor helped keep the course participants on task in a way that helped me to learn.	15			2 13.3%	7 46.7%	6 40.0%	4.27 (0.70)
The instructor encouraged course participants to explore new concepts in this course.	15	1 6.7%	1 6.7%	2 13.3%	4 26.7%	7 46.7%	4.00 (1.25)
Instructor actions reinforced the development of a sense of community among course participants.	15		1 6.7%	2 13.3%	5 33.3%	7 46.7%	4.20 (0.94)
The instructor helped to focus discussion on relevant issues in a way that helped me to learn.	15			2 13.3%	5 33.3%	8 53.3%	4.40 (0.74)
The instructor provided feedback that helped me understand my strengths and weaknesses.	15			5 33.3%	6 40.0%	4 26.7%	3.93 (0.80)
The instructor provided feedback in a timely fashion.	15			5 33.3%	6 40.0%	4 26.7%	3.93 (0.80)

Note. The scale was from 1 (*strongly disagree*) to 3 (*neutral*) to 5 (*strongly agree*). The table includes the number and percent of responses for each question at each point in the scale.

Table 2
CoI Survey Questions Measuring Social Presence

Question	N	Scale					M (SD)
		1	2	3	4	5	
Getting to know other course participants gave me a sense of belonging in the course.	15	1 6.7%	1 6.7%	4 26.7%	5 33.3%	4 26.7%	3.67 (1.18)
I was able to form distinct impressions of some course participants.	15		1 6.7%	4 26.7%	5 33.3%	5 33.3%	3.93 (0.96)
Online or web-based communication is an excellent medium for social interaction.	15			3 20.0%	5 33.3%	7 46.7%	4.27 (0.80)
I felt comfortable conversing through web conferencing.	15			2 13.3%	6 40.0%	7 46.7%	4.33 (0.72)
I felt comfortable participating in the course web conference discussions.	15			2 13.3%	7 46.7%	6 40.0%	4.27 (0.70)
I felt comfortable interacting with other course participants.	15			3 20.0%	6 40.0%	6 40.0%	4.20 (0.77)
I felt comfortable disagreeing with other course participants while still maintaining a sense of trust.	14			4 26.7%	5 33.3%	5 33.3%	4.07 (0.83)
I felt that my point of view was acknowledged by other course participants.	15			3 20.0%	7 46.7%	5 33.3%	4.13 (0.74)
Online web conference discussions help me to develop a sense of collaboration.	15			3 20.0%	10 66.7%	2 13.3%	3.93 (0.59)

Note. The scale was from 1 (*strongly disagree*) to 3 (*neutral*) to 5 (*strongly agree*).

Table 3
CoI Survey Questions Measuring Cognitive Presence

Question	N	Scale					M (SD)
		1	2	3	4	5	
Problems posed increased my interest in course issues.	14			5 33.3%	6 40.0%	3 20.0%	3.86 (0.77)
Course activities piqued my curiosity.	14	1 6.7%		2 13.3%	8 53.3%	3 20.0%	3.86 (1.03)
I felt motivated to explore content related questions.	15			4 26.7%	7 46.7%	4 26.7%	4.00 (0.76)
I utilized a variety of information sources to explore problems posed in this course.	15		1 6.7%	4 26.7%	6 40.0%	4 26.7%	3.87 (0.92)
Brainstorming and finding relevant information helped me resolve content related questions.	15			2 13.3%	6 40.0%	7 46.7%	4.33 (0.72)
Online web conference discussions were valuable in helping me appreciate different perspectives.	15			2 13.3%	8 53.3%	5 33.3%	4.20 (0.68)
Combining new information helped me answer questions raised in course activities.	14		1 6.7%	2 13.3%	6 40.0%	5 33.3%	4.07 (0.92)
Learning activities helped me construct explanations/solutions	15			3 20.0%	7 46.7%	5 33.3%	4.13 (0.74)
Reflection on course content and web conference discussions helped me understand fundamental concepts in this class.	15			3 20.0%	5 33.3%	7 46.7%	4.27 (0.80)
I can describe ways to test and apply the knowledge created in this course.	15		1 6.7%	4 26.7%	7 46.7%	3 20.0%	3.80 (0.86)
I have developed solutions to course problems that can be applied in practice.	15			7 46.7%	7 46.7%	1 6.7%	3.60 (0.63)
I can apply the knowledge created in this course to my work or other non-class related activities.	15		2 13.3%	6 40.0%	4 26.7%	3 20.0%	3.53 (0.99)

Note. The scale was from 1 (*strongly disagree*) to 3 (*neutral*) to 5 (*strongly agree*).

support my ideas"; and, "We have a great compassion for each other and respect each other. [The instructor] does an extremely good job of drawing out the information that we may have slighted."

The third category comprises comments concerning course workload and time management (*n* = 2). Examples include, "The challenges were trying to keep up with the topic" and

> [I had] issues with the time frame. I believe if we weren't as rushed through the material that more people would have a better understanding of the material, but the course was still excellent and [the professor] is very knowledgeable.

The fourth category is a student's comment concerning possible improvements to the course (*n* = 1): "Clearly outline how to get a 10/10 for class participation each day." Apparently, the participation grade rubric left something to be desired in this student's mind.

Discussion

Analysis

These data suggest that the instructor succeeded in designing an online history course that created a community of learners engaged in frequent and relevant interactions and that provided participants with opportunities to work collaboratively to make meaning of course content and to develop their critical thinking skills. The mean for the CoI survey showed that most students agreed or strongly agreed that there was a community of inquiry for the course, $M = 4.07$. Students rated TP as the strongest subscale for the CoI survey, $M = 4.14$. The instructor made intentional design decisions aimed at making large- and small-group discussions as effective as possible by implementing a mandatory attendance policy, requiring completion of quizzes prior to class meetings, giving students focus questions well in advance of class meetings and making participation a significant percentage of the final grade. Students acknowledged the role that the instructor played in developing a strong sense of community by agreeing that the instructor was helpful in guiding the class toward understanding the topics (93.3%), that the instructor helped to focus discussions (86.6%), that the instructor helped keep them on task (86.7%), that the instructor helped build a sense of community (80%), and that the instructor was helpful in identifying areas of agreement and disagreement on course topics (80%).

The CoI subscale that students rated second highest was SP, $M = 4.10$. Students acknowledged their perceived value of using web conferencing by agreeing that they felt comfortable conversing and otherwise participating during the daily meetings (86.7%), and that they felt that online or web-based communication is an excellent medium for social interaction (80%). The students also felt that the discussions enabled them to build strong relationships among course participants by agreeing that they felt comfortable interacting with their peers (80%), and that their point of view was acknowledged by other course participants (80%).

While CP was ranked the lowest of the three CoI subscales, students also gave it a high rating, $M = 3.97$. The instructor included small group discussions to allow students to work together to make meaning of course content. Students acknowledged the efficacy of the small group discussions by agreeing that brainstorming and finding relevant information helped them answer content-related questions (86.7%), that synchronous online discussions were valuable in helping them appreciate different perspectives (86.6%), that reflection on course content and web conference discussions helped them understand fundamental concepts (80%), and that the learning activities helped them construct explanations and solutions (80%). Responses to the open-ended prompts also suggest that students found the instructor effective and believed that the course design made it possible for them to work collaboratively.

In traditional lecture halls it is often challenging to have meaningful, broad student participation during class meetings due to the large number of students in the room. Web conferencing technology allowed the instructor to quickly get feedback from students by asking them to use tools such as emoticons, text-chat, and polling. Another benefit of the online class was the ability to quickly send students to their breakout rooms, as well as the ability to move easily from room to room to monitor students' progress. This is a real challenge in a face-to-face environment since having students move from fixed theater-style seating often presents logistical challenges. While the current online class numbers were small (*n* = 19), the web conferencing tools would scale equally well for large enrollments that mirror those of the face-to-face sections.

Study Limitations and Future Research

The online history course under investigation demonstrates that it is possible to design online classes that have high levels of community of inquiry as a result of students working collaboratively to make meaning of course content. Since there were only 19 students enrolled in this course, the results of this study cannot be generalized to all online teaching environments.

This research study was conducted in an online class that utilized web conferencing. Research can be

conducted in other online classes with a similar course design to see whether the results can be replicated. The instructor also plans to redesign his face-to-face class to achieve the same goals and plans to use clickers and small-group discussion to encourage participants to develop a community of inquiry working together to make sense of course materials and develop critical thinking skills. It would be interesting to compare the results of this study to others conducted on similar courses offered in face-to-face learning environments.

This was one of the first synchronous online courses offered to undergraduate history students at the university, and the large number of students that dropped the class suggests that some students may not be adequately prepared to participate in such courses. In the future, the instructor plans to follow up with students who withdraw from the course to get a better sense of their reasons for doing so.

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Appendix
Community of Inquiry Survey

Arbaugh et al. (2008) developed the 34-item Community of Inquiry (CoI) Survey to measure the level of community with sub measures for instructor presence, social presence, and cognitive presence. Five items that were slightly modified in the present study to be worded properly for the students that accessed their communications using web conferencing (Questions 17, 18, 22, 28, and 31).

5-point Likert-type scale:
1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, 5 = *strongly agree*

Teaching Presence
1. The instructor clearly communicated important course topics.
2. . The instructor clearly communicated important course goals.
3. The instructor provided clear instructions on how to participate in course learning activities.
4. The instructor clearly communicated important due dates/time frames for learning activities.
5. The instructor was helpful in identifying areas of agreement and disagreement on course topics that helped me to learn.
6. The instructor was helpful in guiding the class towards understanding course topics in a way that helped me clarify my thinking.
7. The instructor helped to keep course participants engaged and participating in productive dialogue.
8. The instructor helped keep the course participants on task in a way that helped me to learn.
9. The instructor encouraged course participants to explore new concepts in this course.
10. Instructor actions reinforced the development of a sense of community among course participants.
11. The instructor helped to focus discussion on relevant issues in a way that helped me to learn.
12. The instructor provided feedback that helped me understand my strengths and weaknesses.
13. The instructor provided feedback in a timely fashion.

Social Presence
14. Getting to know other course participants gave me a sense of belonging in the course.
15. I was able to form distinct impressions of some course participants.
16. Online or web-based communication is an excellent medium for social interaction.
17. I felt comfortable conversing through the online medium.
    WC: I felt comfortable conversing through web conferencing.
18. I felt comfortable participating in the course discussions.
    WC: I felt comfortable participating in the course web conference discussions.
19. I felt comfortable interacting with other course participants.
20. I felt comfortable disagreeing with other course participants while still maintaining a sense of trust.
21. I felt that my point of view was acknowledged by other course participants.
22. Online discussions help me to develop a sense of collaboration.
    WC: Online web conference discussions help me to develop a sense of collaboration.

Cognitive Presence
23. Problems posed increased my interest in course issues.
24. Course activities piqued my curiosity.
25. I felt motivated to explore content related questions.
26. I utilized a variety of information sources to explore problems posed in this course.
27. Brainstorming and finding relevant information helped me resolve content related questions.
28. Online discussions were valuable in helping me appreciate different perspectives.
    WC: Online web conference discussions were valuable in helping me appreciate different perspectives.
29. Combining new information helped me answer questions raised in course activities.
30. Learning activities helped me construct explanations/solutions.
31. Reflection on course content and discussions helped me understand fundamental concepts in this class.
    WC: Reflection on course content and web conference discussions helped me understand fundamental concepts in this class.

32. I can describe ways to test and apply the knowledge created in this course.
33. I have developed solutions to course problems that can be applied in practice.
34. I can apply the knowledge created in this course to my work or other non-class related activities.

Open-Ended Questions
35. Please comment of the success of this class being designed as a group of individuals that have worked together to help develop a deeper understanding of the content of this course.
36. Please comment on the challenges of this class being designed as a group of individuals that have worked together to help develop a deeper understanding of the content of this course.
37. Please make any suggestions that would improve this class being designed as a group of individuals that work together to help develop a deeper understanding of the content of this course.

*See http://communityofinquiry.com/methodology for more information on the Community of Inquiry Scale.

The Impact of a Faculty Training Program on
Teaching Conceptions and Strategies

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This article presents a preliminary study of a faculty development program at a university in the Northeastern United States, exploring how the program influenced instructors' teaching conceptions about teaching in general and themselves as educators, and teaching approaches , including intended and adopted strategies. Interviews with 12 participants were conducted and analyzed; the theoretical orientation for the analysis was the grounded theory approach, and the constant comparative method of analysis was used. Findings indicate that the program influenced all of the participants' teaching conceptions in various ways (seven themes) and facilitated a shift towards a student-centered approach to teaching. Additionally, the program influenced all of the participants' teaching approaches (16 intended or adopted strategies), leading to the use of active learning methods. This study adds to the literature on the impact of pedagogical training programs for faculty, which is crucial as there is an increase in faculty development centers.

In 1997, Pratt observed that, despite attempts to highlight the value of teaching by several scholars in the 1990s (e.g., Boyer, 1990; Rice, 1992), teaching continued to be actively devalued in higher education, especially in comparison to research. Indeed, over the last decades, there has been a growing imbalance between rewards for teaching and for research with the latter being emphasized (Fairweather, 2005; Huber, 2004). While research-intensive universities in the United States may express the importance of high-quality teaching, they mainly focus on research when it comes to promotion and tenure (Leslie, 2002; Wright, 2005). Faculty members are not required to receive pedagogical training in the United States (Tanner & Allen, 2006) or in several European countries (Postareff, Lindblom-Ylänne, & Nevgi, 2007) and thus are not prepared to teach effectively. Research suggests that increased teaching experience does not necessarily improve instructors' teaching approaches or teaching-related perceptions (e.g., Norton, Richardson, Hartley, Newstead, & Mayes, 2005; Richardson, 2005), which further implies the importance of opportunities for instructors to develop teaching skills. In recent years in the United States, such opportunities have become more accessible due to an increasing number of faculty development centers across higher education institutions (Light, Calkins, Luna, & Drane, 2009). Faculty pedagogical training has been increasing throughout Europe as well: it is well established at some universities in England and Norway (Gibbs & Coffey, 2004), and it is mandatory at some universities in Sweden (Sonesson & Lindberg Sand, 2006) and the Netherlands (van Keulen, 2006).

With the increase in faculty development centers, there has also been increasing research on these centers and the pedagogical training programs they offer (e.g., Eggins & MacDonald, 2003; Postareff et al., 2007). The impact of the centers and their programs needs to be explored continuously and effective program models need to be shared across institutions (Light et al., 2009).

This article presents an evaluation of an intensive pedagogical training program and its effects on participating faculty members at a large urban university in the Northeastern United States. It is the preliminary study of a longitudinal research project where yearly iterations of the program are explored.[1] Similar to an increasing number of studies which focus on how programs might impact faculty teaching approaches (Ho, Watkins, & Kelly, 2001; Trigwell, 2003), this study explored the ways in which the training program influenced faculty's teaching conceptions, including opinions and attitudes related to teaching in general and themselves as educators, and faculty's teaching approaches, including intended and adopted teaching strategies. One-on-one interviews with 12 instructors who participated in the program were conducted and analyzed. Findings suggest that the program influenced faculty members' teaching conceptions and teaching approaches in various ways. Moreover, instructors not only intended to adopt teaching strategies that they learned during the program but also started actively incorporating these strategies into their own teaching.

Teaching Conceptions and Teaching Approaches

Various studies have examined educators' teaching conceptions and teaching approaches (Kember, 1997; Samuelowicz & Bain, 1992, 2001; van Driel. Verloop, van Werven, & Dekkers, 1997; Wood, 2000). Teaching

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[1] In the present study, we reanalyzed data from another investigation, which was published in 2013 (Gunersel, Barnett, & Etienne, 2013). While the previous study analyzed the data through the theoretical lens of self-authorship, in the current study, we used a purely emergent design to evaluate the training program and address different research questions.

conceptions have been defined as the way in which educators conceive of, or understand, teaching and learning, while teaching approaches have been defined as educators' actual teaching strategies and intentions (Prosser & Trigwell, 1999b). Research has revealed that conceptions and approaches can range between two broad orientations: a teacher-centered orientation and a student-centered orientation (Åkerlind, 2003; Trigwell & Prosser, 2004). According to a teacher-centered orientation, teachers possess knowledge that they transmit or impart to students, and the focus is on the subject, the content, and the teacher's actions (Samuelowicz & Bain, 1992). Meanwhile, according to a student-centered orientation, teachers take into account students' existing conceptions and facilitate student learning and conceptual change by engaging students with interactive classroom activities and authentic assessment activities (Prosser & Trigwell, 1999b).

Research suggests that educators' teaching conceptions influence their teaching approaches (Donche & Van Petegem, 2011; Kember & Kwan, 2000; Prosser & Trigwell, 1999a). Teachers whose teaching conceptions lean towards a teacher-centered orientation tend to use teacher-centered teaching strategies, such as extensive lecturing, whereas those who have more student-centered teaching conceptions tend to use more student-centered teaching strategies (Kember & Kwan; 2000; Eley, 2006) which engage students, requiring them to do meaningful learning activities and to reflect on the activities (Bonwell & Eison, 1991), which in turn leads to enhanced learning (Benek-Rivera & Matthews, 2004; Blanchard et al., 2010; Derting & Ebert-May, 2010; Sarason & Banbury, 2004; Watkins, 2005).

There is also a relationship between instructor approaches to teaching and student approaches to learning (Kember & Gow, 1994; Prosser & Trigwell, 1999b), which influence the quality of student learning outcomes (Trigwell & Prosser, 1991). Students' approaches to learning have been categorized as either "deep" or "surface" according to the adopted strategies of studying and intentions behind those strategies (Prosser & Millar, 1989). Students with a deep approach to learning intend to understand the main ideas and find meaning within the concepts, and they adopt strategies such as "relating and distinguishing evidence and argument, looking for patterns and underlying principle" (Prosser, & Trigwell, 1999a, p. 40). Thus, teachers with a student-centered orientation tend to use student-centered teaching strategies, all of which correlate more strongly with students' deeper approach to learning, leading to enhanced learning outcomes.

Some researchers suggest that instructors' teaching conceptions need to shift towards a more student-centered orientation before improvement of actual teaching can take place (Henderson, Beach, & Finkelstein, 2011; Ho et al., 2001; Oosterheert & Vermunt, 2003). This suggests that pedagogical training programs should target teaching conceptions as well as learned teaching strategies. In turn, if we are to determine the effects of a pedagogical program, it is important to explore the influence the program had on instructors' perceptions as well as strategies adopted (Kember, 1997).

The Faculty Training Program

The faculty training program that is the focus of this study is part of a graduate student certificate program on teaching in higher education at a large urban university in the Northeastern United States. Faculty members who teach the core course of the certificate program are nominated by the dean's office at their school or college, receive a small stipend and participate in the training program to prepare to teach the course.

The training program consists of 12 three-hour sessions over the course of 5-6 weeks during the summer and is facilitated by the staff of the faculty development center. During the program, faculty members experience the core course of the certificate program as "students" and enhance their knowledge of how people learn and of research-based teaching practices. The first four sessions of the program focus on research and theories of learning and development, learner-centered teaching and reflective practice. The next four sessions focus on integrated course design, various teaching methods and the effective use of technology in the classroom. The remaining four sessions focus on diversity and inclusive teaching, and microteaching.

The program reflects the two assumptions under the *learning partnerships model*—structured experiences that facilitate individuals' personal growth and development (Baxter Magolda, 2004)—that "knowledge is complex and socially constructed" (p. 41) and "authority and expertise are shared in mutual construction of knowledge among peers" (p. 42). First of all, through readings and activities, instructors are exposed to the idea that knowledge is socially constructed, a core value of the program. By participating in discussions, case studies and small group work, instructors are able to develop their own understanding of the material through the lenses of their backgrounds and disciplines. An important part of this process is that instructors come from different disciplines and thus are able to share their unique experiences and backgrounds and learn from each other.

Each session demonstrates relevant teaching activities by engaging faculty in the activities as learners and ending with a discussion of how faculty

would teach the material to their graduate students. For example, while discussing integrated course design, instructors developed learning goals followed by assignments that were aligned with the goals. While discussing feedback and assessment, instructors developed rubrics. While discussing effective discussions, instructors participated in various techniques, such as Brookfield and Preskill's (2005) conversational moves and snowball technique. Instructors experienced various methods of small group work, collaborative learning, and effective discussion, including technological tools, throughout the program and received guidelines on how to use each method in their own classroom.

In addition to participating in the training program, each individual faculty member designs his or her own "teaching in the discipline" module for the course to address pedagogical issues common to his or her field. For example, the course taught in the physical sciences section provides lessons on how to teach lab or how to teach problem solving. Instructors have the opportunity to modify the course, but the staff of the faculty development center must approve the final syllabus as remaining sufficiently consistent with the established curriculum.

Methods

The main research questions of this study were: (1) In what ways did the training program influence participating faculty members' teaching conceptions, including opinions and attitudes related to teaching in general and themselves as educators? (2) In what ways did the program influence faculty members' teaching approaches, including adopted and intended teaching strategies? In order to gain an in-depth understanding of participating faculty members' experiences and the program's impact, qualitative research methods were employed (Merriam, 1998).

Twelve of the 16 faculty members who attended the training program during the summer of 2009 were interviewed. Four of the faculty members taught in the

social sciences, four in sciences, two in humanities, one in arts, and one in health professions. Five were female and seven were male; ages ranged from 40 to 70. Eight instructors were White (one of whom was international) and four were Black (one of whom was international). Semi-structured interviews, which were conducted by either a researcher or research assistant, were audio taped and transcribed.

The theoretical orientation for the analysis was the grounded theory approach, which utilizes an emergent design, where patterns and themes emerge from the data (Glaser & Strauss, 1967). The constant comparative method of analysis, including comparing incidents that pertain to categories and integrating categories, was used (Lincoln & Guba, 1985). Two researchers conducted the analyses of the interviews independently and then compared analyses and reached consensus, which increased the reliability by employing investigator triangulation (Patton, 2002).

Findings

Teaching Conceptions

All of the 12 instructors indicated that their teaching conceptions, including opinions and attitudes related to teaching in general and themselves as educators, shifted in some way after participating in the training program. Seven themes emerged from the data; the themes, along with the number of instructors who mentioned them, are presented in Table 1.

The program helped instructors understand a student-centered approach and shift away from a teacher-centered approach. This was the most frequently emerging theme, present in interviews with seven instructors. One instructor noted that she started seeing teaching as a more collaborative process between instructors and students after participating in the training program. Another instructor noted that the program helped equip him with "tools to make the students part of the knowledge construction process." When asked whether her attitudes and beliefs about

Table 1
Emergent Themes and Number of Instructors Who Mentioned Each Theme

Theme ("The training program led the instructor to . . . ")	Number of instructors
understand and shift towards a student-centered approach.	7
develop self-awareness and self-reflection as an educator.	5
consider students' backgrounds, diversity, and developmental stages while teaching.	5
become open to trying new teaching methods.	3
change views on teaching, content, and course design.	2
feel energized and confident as a teacher.	2
gain interest and understanding of pedagogical theories and research in relation to practice.	2

teaching changed, one instructor noted that she started thinking about teaching differently after the program:

> Yeah, [they] changed. *A lot* changed. . . . [After the program] I know I need to lead the way and put myself into the *learning* side instead of teaching side. *Learning* with the students will probably end up better than *teaching* the students. . . . The philosophy they [the trainers at the program] have—*that* changed my view on teaching, totally.

The program facilitated instructors' self-awareness and self-reflection as educators. This theme emerged from interviews with five different instructors. For example, one instructor explained how he started reflecting on his teaching during the program and how he realized that a lot needed to change. Another instructor said that she became more conscious of pedagogical issues of which she had not previously been aware. One instructor noted that although she was still figuring out her personal approach to teaching, the training program provided her with some direction for developing it.

The program led instructors to consider students' backgrounds and developmental stages. This theme emerged from interviews with five different instructors who articulated that the training program helped them gain a broader perspective of where students are coming from and prompted them to further reflect on the importance of considering student diversity while teaching. One instructor indicated that the discussions on diversity during the program really helped her think about the topic, calling it "transformative." Another instructor noted,

> Embracing diversity . . . that's something that occurred to me during training program. And it [the teaching method learned in the training program] was a way that I *might* be able to convey the same material to different kind of learners.

The program led instructors to become open to new teaching methods. This theme was present in three interviews. One instructor noted that "as a result of this program" she was "willing to try things" and was "open to experimentation." Another instructor pointed out that after completing the program, he thought, "Oh ok, now I'm ready to make huge changes [to my teaching]."

The program modified instructors' views on teaching, content, and course design. This theme was present in two interviews. One instructor explained how a specific activity in the program—identifying and categorizing learning goals—changed her view on teaching and her notion of what course design entails:

> This [activity] was actually most useful in the sense that it really allowed me to rethink the whole process of teaching a course—to go beyond just selecting a textbook, writing a syllabus, and just singing a song for an entire semester. I got to think of this as an entire *process* that people have to go through and they need to come out of this whole experience with something of *value*, not just a bunch of data or whatever they're asked to reproduce.

The other instructor noted that he realized "how much work preparing" was and that it was not "always about the content."

The program led instructors to feel energized and confident as educators. This theme was present in two interviews. Emphasizing that the program "energized him about teaching," one instructor noted that he now felt "very confident" and "excited" about teaching. Another instructor stated that he "felt like his teaching mojo came back" after the program and that he "was energized and got back in touch with what makes him feel good about what he does" which he described as "having an impact on the success of students."

The program led instructors to gain interest and understanding of pedagogical theories in relation to practice. This theme was expressed by two instructors, one of whom pointed out that the training program helped him see the connection between best teaching practices and theories of learning. The other instructor explained his growing interest in pedagogy and educational research during the program:

> I went into it with a *little* bit of knowledge about scholarship on teaching. I had been involved in that a little bit before. So I knew a *little* bit about where we were going. But I think for me it was a case of not knowing all that I *didn't* know and if anything it illustrated to me how broad and deep this field is and what the other areas of exploration are and here's more stuff that I *didn't* know was out there. So it's made me very curious to explore this more.

Teaching Approaches

Findings suggest that the training program influenced faculty's teaching approaches, including adopted and intended teaching strategies. All 12 of the instructors indicated that they started actively incorporating new strategies into their teaching after the program. A total of 16 specific teaching approaches emerged from the data and were grouped under six categories, which are presented in Table 2, along with the number of instructors who mentioned them.

Using active learning methods. There were four teaching approaches that faculty members adopted after

Table 2
Teaching Approach Categories, Number of Specific Teaching Approaches, and
Number of Instructors Who Mentioned Each Category

Categories	Specific teaching approach	Number of instructors
Using active learning methods	4	12
Adopting and/or improving of instructional technology use	2	5
Improving feedback and assessment	2	3
Improving course design	2	2
Encouraging students to reflect on learning and assess own work	1	3
Other	5	5

participating in the program that were grouped under this category. The teaching approaches, which emerged 15 times from the interviews with all 12 faculty members, can be considered active learning methods, which can be defined as any teaching method that engages students through meaningful learning activities (Prince, 2004).

The two most frequently emerging teaching approaches were using classroom discussions and small group work, each expressed by five instructors. While one instructor noted that the program helped him realize how small group work could actually function, another instructor stated, "[After the program] instead of rushing and just treating lecture as the standard, I decided to open it up more for student discussion and see what they had to say about it." One instructor pointed out that she started using different classroom discussion techniques, such as the snowball technique and conversational moves (Brookfield & Preskill, 2005).

The third teaching approach that fit this category was encouraging students to directly engage with the material through hands-on activities instead of lecturing, which was expressed by three instructors. One instructor said that he began breaking up lectures by incorporating engaging activities based on the techniques he learned during the training program.

The fourth teaching approach was encouraging students to ask questions and participate, which was expressed by two instructors.

Adopting and/or improving of instructional technology use. The two teaching approaches that were grouped under this category emerged from interviews with five different instructors, who noted that they started using instructional technology or improving their use of instructional technology after the program. Two instructors noted that they changed the way they used PowerPoint and increased the effectiveness of their use, while two others pointed out that they incorporated clickers—audience response systems integrated with PowerPoint that allow the audience to actively participate in the presentation—after using them in the program. One instructor said he started using blogs to encourage discussion among students.

Improving feedback and assessment. The two teaching approaches that were grouped under this category (providing detailed feedback with guidelines for improvement and using rubrics) emerged from interviews with three instructors. One instructor explained, "I look at their work, see what kind of mistakes they make, recommend certain procedures maybe for improving, giving them guidance."

Improving course design. The two teaching approaches that were grouped under this category emerged from interviews with two instructors. One instructor began developing learning objectives for his class after participating in the program:

By going through this process of selecting the teaching goals—I mean, there are all sorts of—I forgot the exact activity–but I remember I actually sat down and thought for a while how to actually make this *work,* how to put the categories and how to organize the entire thing—what do you want these people to come away with after it's a one-semester experience in such and such a thing.

Another instructor started focusing on the alignment of course elements, as the program taught him the importance of aligning learning goals and classroom activities. He also noted he was "much more in tune" with how various course elements should be integrated.

Encouraging students to reflect on learning and assess their own work. The teaching approach that fit this category emerged from interviews with three instructors. One instructor noted:

I really worked on getting my students to think about what they were learning, getting them to have a dialogue with *me* about *what* they were learning that I could then—actually it's a feedback loop—I could then incorporate and we can continue to grow.

Other. Five other teaching approaches emerged once from interviews with five instructors. One

instructor started linking the class material to what students can directly relate to after the training program:

> I started to think of some things that I had not actually done; for instance, I came up with the idea of having students bring up their phones and I would bring in a scale . . . and explain to them what variables are—numeric, non-numeric—in the introductory lectures of the class. They brought their cell phones and weighed them and then I had them indicate what the brand was; whether it was touch screen; to talk about different kind of variables; how we would determine what kind of analysis to use depending on the type of data. And it got them out of their seats and it was one of the best first classes that I can remember having—it was an honors class. And I just felt a little fresher trying something new. It had been a long while since I had really tried something that different than just going over the syllabus and so on.

Another instructor began incorporating writing assignments, while one started providing students with opportunities for trial, error and improvement as he "tried to emphasize further, 'it's ok to be wrong while you're learning. You won't be penalized.'" One instructor started incorporating creative research projects where students "research people prominent in the field." Another instructor began explaining connections between units and concepts by specifically pointing out how the different units were linked so that the students would understand the units' overall connection.

Discussion

Our findings suggest that the faculty training program influenced the 12 participating instructors' teaching conceptions and teaching approaches. All of the instructors indicated that their opinions and attitudes related to teaching in general and themselves as educators shifted in some way after the program, which was reflected in seven themes that emerged from the data. Similarly, all of the instructors indicated that the program had an impact on intended and adopted teaching strategies, and 16 teaching approaches emerged from the data. This study adds to the literature on the impact of pedagogical training programs for faculty, which is crucial in a period where there is an increasing recognition of the importance of such training (Light et al., 2009; Wilson, 2002). This kind of training, which is becoming a global trend (Gibbs & Coffey, 2004; Sonesson & Lindberg Sand, 2006; van Keulen, 2006), is often the only opportunity instructors get to learn about effective teaching practices.

The training program's influences on instructors' teaching conceptions and approaches fit the three categories outlined in Åkerlind's (2003) study reflecting academics' experiences of growth and development as educators: change within themselves, change in teaching practices, and change in learner outcomes. The first category, "teaching development as a change within the teacher" (Åkerlind, 2003, p. 380), is based on instructors' focus on themselves and on their increased "comfort and confidence with teaching" (p. 380). Our findings indicate that the program influenced instructors' experiences within this category, as the way they viewed themselves as educators shifted. Some instructors explicitly noted that the program increased their confidence and energy levels as educators, while others noted that they became more aware of themselves as educators and started to reflect on their teaching after the program.

Åkerlind's (2003) second category, "teaching development as a change in teaching practice" (p. 381), is based on instructors' focus on the quality of teaching and on developing "teaching skills, in terms of strategies and methods, teaching materials and/or knowledge of the area" (p. 381). This category also includes instructors' intention to become more effective educators. When compared to our study, this category reflects both teaching approaches (adopted and intended teaching strategies) and some of themes under teaching conceptions (including opinions and attitudes related to teaching). A major finding of our study is that the program led instructors to start using active learning methods, which promote student learning and are consistent with a student-centered teaching approach (Bonwell & Eison, 1991; Picciano, 2002; Weimer, 1991). This finding supports former research suggesting that faculty development programs enhance the use of learner-centered approaches (e.g., Gibbs & Coffey, 2004; Light et al., 2009; Postareff et al., 2007) and have a positive impact on faculty teaching (e.g., Coffey & Gibbs, 2000; Light, Luna, Drane, & Fleming, 2004). Furthermore, the program also influenced teaching conceptions; for example, some instructors became more open to trying new teaching methods, while some started viewing teaching, content matter and course design differently.

Åkerlind's (2003) third category, "teaching development as a change in outcomes for the learner"(p. 382), is based on instructors' focus on student learning and represents growth that "shows a critical expansion in the experience to include awareness of developmental changes for students" (p. 382). Thus, this category, which reflects instructors' adoption of a more student-centered orientation, is directly linked to a major finding of our study: the program not only helped instructors develop a better understanding of a student-centered approach but also

led them to adopt a more a student-centered model while thinking of their teaching. For example, instructors realized, during the program, that they needed to focus on student learning as opposed to their own teaching, that teaching should be a collaborative effort between the student and instructor, and that they needed to move away from the notion that they are the sole center of the classroom. Instructors also began further reflecting on diversity-related issues and considering students' backgrounds and developmental stages while teaching.

Findings suggest that various aspects of the training program were effective in influencing participating instructors' teaching conceptions and approaches. An important feature of the program was its reflection of the assumptions that "knowledge is complex and socially constructed" (Baxter Magolda, 2004, p. 41) and "authority and expertise are shared in mutual construction of knowledge among peers" (p. 42). Additionally, the program's flexibility invited each instructor's input and modifications for the course they would teach. Instructors designed their own teaching in the discipline module for the course to address issues common to their field and modified the course's syllabus, as long as it remained sufficiently consistent with the established curriculum. Thus, the variety of their fields and the unique teaching challenges present in each field could be addressed.

The program's format, which prompted instructors to participate in various teaching and learning activities as learners, effectively provided them a toolbox for teaching and resulted in instructors incorporating the activities in their own teaching, feeling more confidence and energy in regards to teaching and adopting a more student-centered model. Extensive discussions and activities on reflective teaching, intellectual development, inclusive teaching and universal design influenced instructors' self-awareness as educators and approach to students' backgrounds and needs. For example, after reflective teaching was explained, instructors discussed their own powerful learning experiences and the facilitators pointed out the common characteristics of the experiences. After instructors heard about the demographics of the university's student population, they filled out a worksheet with questions prompting them to explore their own backgrounds, attitudes, and prejudices while teaching, such as "Do you inadvertently undervalue comments made by speakers whose English is accented differently from your own?" While this activity was private, it was opened to discussion for those who wanted to share.

The facilitators of the program implemented the practices of reflective teaching and student-centered teaching by meeting after each session to discuss what worked, what didn't work and what needed be improved

and addressed. They created the following session's lesson plan based on the experiences from that day's session and the needs and wants of the instructors.

The context in which the program flourished is also important, as context is crucial in educational research (Howell, 2008). The training program is part of a graduate student certificate program on teaching in higher education that was created by the staff of the university's faculty development center after the invitation of the provost. The Provost's support for the initiative to improve graduate students' teaching expertise influenced many deans and faculty, and the faculty development center met with schools and colleges to enlist their support. Meanwhile, faculty members who participated in the training program were recognized as leaders in teaching and were nominated by the Dean's office. It was important for faculty to hear from their colleagues that the program was an opportunity for growth.

Conclusion

Participating faculty's gains and transformations through the training program suggest that the program model is especially promising, since all the results took place in spite of the fact that the program was only 5-6 weeks long and consisted of 12 three-hour sessions, which is not long: former research indicates that teaching conceptions and approaches change slowly (e.g., Postareff et al., 2007) and that paradigm shifts take time to occur (Kuhn, 1970). Of course, the outcomes of this study reveal the immediate results of the program, not the long-term results; future research will investigate the long-term impact of the program as well as explore changes in student learning outcomes based on instructors' changing teaching conceptions and approaches after participation. Although the current study cannot determine the program's indirect influence on student learning, increase in student learning outcomes may be foreshadowed by the instructors' adoption of various student-centered teaching strategies learned during the program, which lead to active learning and, and in turn, to enhanced learning outcomes. It should also be noted that since faculty were nominated by the dean's office and volunteered to participate in the program, it is most likely that they were already prone to modifying their teaching approaches.

The main aspects of the program that facilitated its success were: (a) its core values, including constructivism and student-centered teaching; (b) its inclusion of instructors from different disciplines and the acknowledgement that each field brings with it a different set of teaching challenges; (c) its format prompting instructors to participate in teaching and learning activities as learners; and (d) its inclusion of extensive discussions and activities related to reflective

and inclusive teaching, diversity, and self-awareness. Additionally, program facilitators created each session's lesson plan according to the needs and wants of the instructors. The support of the provost and the positive association related to the program were also helpful factors in its success.

This is the preliminary study of a longitudinal research project where yearly iterations of the faculty training program are explored. This study focused on the participants of the first training program, which took place in 2009; currently interviews with the participants of the second and third iterations of the training program, which took place in 2010 and 2011, are being analyzed.

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Acknowledgments

Cultivating Design Thinking in Students Through Material Inquiry

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Design thinking is a way of understanding and engaging with the world that has received much attention in academic and business circles in recent years. This article examines a hands-on learning model as a vehicle for developing design thinking capacity in students. An overview of design thinking grounds the discussion of the material-based specialized studio course, Felt Construction. The pedagogical context as well as the components and organization of the course are considered through case studies. The effectiveness of course design is analyzed, and the relevance to other disciplines is addressed, with the intention of providing some flexible strategies that may be used in course design where cultivating design thinking is an objective.

Design thinking may be defined as a process and a frame of mind put into action to effect positive change in the world. This strategy is touted in popular and scholarly literature as a paradigm for generating innovative ideas. Design thinking may be developed in students through a learning model that combines hands-on exploration with opportunities to apply and test the knowledge gained for the purpose of preparing today's aspiring professionals to become contributing citizens and effective shapers of the future. This approach raises several questions, including: What is the value of knowledge gained through hands-on experimentation with a raw material and how does it translate to better student outcomes in design projects? This question is explored through the examination of a design-related media course called Felt Construction, a course grounded in design thinking, studio culture, and the design process. This course was revised over five years based on observation and student feedback for the purpose of generating the most effective dialogue between student discovery, creative problem solving and the implementation of student ideas.

Design Thinking: Past and Present

The term *design thinking* has roots in various disciplines and is frequently, although not exclusively, associated with engineering, architecture and related design disciplines in early literature focused on design thinking. Donald Schön's *The Reflective Practitioner* (1983), Bryan Lawson's *How Designers Think* (1990), and Peter Rowe's *Design Thinking* (1987) are three foundational texts addressing the idea of design thinking with respect to these professions. Schön (1983) used the term *reflection-in-action*, whereas Lawson (1990) and Rowe used (1987) the term design thinking; in both cases they refered to a way of seeing and understanding the world while working to bring about desired change. Each of the authors set out to analyze the process of design and identify characteristics of design thinkers. Commonalities in the analyses of the design process include the concept of *framing*, the strategy of approaching new situations by relating them to a repertoire of past experience, the need for iteration and the importance of both divergent and convergent thinking processes (Lawson, 1990; Rowe, 1987; Schön, 1983). In other words, a designer demonstrates the capacity for recognizing opportunities for improving a situation in which the problem to be solved has not been explicitly defined. In defining the problem, the designer frames it. While approaching each new situation with attention to the specifics that make it unique, he/she is able to draw on similarities with previous experiences to help define a strategy of inquiry and intervention (Schön, 1983). Divergent thinking is associated with imagination and intuition and is said to open up the problem space, whereas convergent thinking is associated with logical and rational thought and is said to narrow in on possible solutions (Schön, 1983). Framing and evolving problems in parallel with solutions entails revisiting and revising ideas through iteration (Dorst, 2011; Goldschmidt & Rodgers, 2013; Steen, 2013). These views align closely with the philosophy expressed by Dewey (1938) where he placed value on students learning from firsthand experiences and relating their prior experiences to new information. Rather than learning from books, Dewey (1938) asserted that students learn more effectively from their environment: "What [the student] has learned in the way of knowledge and skill in one situation becomes an instrument of understanding and dealing effectively with the situations which follow" (Dewey, 1938, p. 42). The focus of Dewey (1938), Rowe (1987), and Schön (1983) on thinking, doing, and reflecting emerged out of the tension between theory and practice that has long existed, and continues to be an issue of contention, in academic professional programs. The separation of thinking from making has been attributed to the advent of industrial production (Cross, 2011). Advocates of design thinking in general education (Cross, 1982) and in higher education (Goldschmidt & Rodgers 2013; Razzouk & Shute, 2012; Rowe, 1987) have asserted the need for developing thinking as a skill in all students.

Design thinking, design process, and the value of making things by hand have gained much popular interest in recent years. The renewed interest in making is due in part to the DIY. (do-it-yourself) movement and the Maker Faire phenomenon, which offer enthusiasts of many stripes the opportunity to exercise their creative capacities. Companies like IDEO and Luma Institute have advocated and marketed design thinking as a strategy for identifying opportunities to improve the human experience. *Human-centered design* and *user-centered design* are related concepts that have traditionally been associated with industrial or product design, but are more and more being used outside of those disciplinary boundaries. These current trends highlight two of the underlying tenets of design; design implies a degree of social responsibility and the practice of design offers the possibility of seeing one's ideas materialized in the world in a concrete way. Brown and Wyatt (2010) discussed design thinking as seen and practiced by IDEO. The author identified three overlapping spaces of the process, which are undertaken in a non-linear sequence and several times throughout the design process: inspiration, ideation, and implementation (Brown & Wyatt, 2010). Although the terminology applied to these spaces varies within current teaching-related literature, the characterization of the design process as non-linear and consisting of spaces rather than steps is a recurring theme. Many authors have agreed that in an effective design process, the sequence and frequency with which the steps are undertaken will vary according to the specifics of the situation (Brown &Wyatt, 2010; Hatcheul & Weil, 2009; Lawson, 1990; Owen, 2007; Razzouk & Shute, 2012; Schön, 1983; Seitamaa-Hakkarainen & Hakkarainen, 2001; Stempfle & Badke-Schaub, 2002). Dorst (2011) characterized the design thinking process in terms of abductive reasoning where the "how" and the "what" are unknown, but the value, or the desired goal, is known. The ambiguity and uncertainty associated with design problems has given rise to the terms *ill-structured* and *ill defined*, which have commonly been used to differentiate design problems from more explicitly defined problems (Cassim, 2013; Goldschmidt & Rodgers, 2013; Reboy, 1989). Owen (2007) asserted that knowledge is generated and accumulated through action. He added that knowledge is used to produce works, which are in turn evaluated to build knowledge.

Design Thinking in the Classroom

A review of literature addressing the implementation of design thinking pedagogy reveals several consistent themes. Arguments for the intrinsic educational value of designerly ways of knowing include assertions that design activity (a) develops students' abilities to solve real-world, ill-defined problems; (b) provides opportunities for the development of concrete/iconic modes of cognition; and (c) develops nonverbal thought and communication (Cross, 1982) through various methods of making, including sketching and modeling, or prototyping (Dörner, 1999). Reboy (1989) stated that instructional design can better prepare students for problems in adulthood if projects and other more closely mock real-world situations. The persistent dominance of scientific and analytical thinking in education and the need for balancing these with other modes of cognitive activity are cited as both obstacles to, and rationales in favor of, incorporating elements of design thinking into instructional design (Cassim, 2013; Cross, 1982).

Another recurring theme in the literature is the value of hands-on learning. Dowling (2012) traced the lineage of kinesthetic creation in pedagogical design from the Renaissance to the present day. Pestalozzi's espousal of active, hands-on, and self-directed learning in the 18th century, Froebel's hands-on exercises or "gifts," Piaget's constructivism, and Kolb's experiential learning and constructionism constitute a long history of support for kinesthetic learning in pedagogical design. Dowling (2012) followed this theoretical grounding with an example of a full-scale design and building project embedded in a design technology course. In the two-part assignment, students prepare a schematic design for a space between two existing interior volumes. Quarter-scale models, 3-D drawings, hand sketches, and written research are among the tools used to investigate and develop a solution. In the second phase, teams select and modify one student's design, which is subsequently reviewed, revised and built full-scale. Dowling (2012) used this project to illustrate that tactile learning invites experimentation and exploration. She posited that kinesthetic strategies offer significant potential to a wide range of curricula, citing the benefits to students in the form of increased sensory awareness, immediate and deeper learning, and an increased sense of authorship (Dowling, 2012).

Some articles present case studies where students were observed designing and attempt to draw conclusions about design activities and the relevance of design thinking in education from these individual case studies (e.g., Lim, Lim-Ratnam, & Atencio, 2013; Seitamaa-Hakkarainen & Hakkarainen, 2001; Stempfle & Badke-Schaub, 2002). Many courses studied in the literature are interdisciplinary, situated within the traditional design disciplines or within engineering. Stempfle and Badke-Schaub (2002) analyzed the processes of mechanical engineering students designing a mechanical concept for a planetarium. Bower (2011) used an online computer programming course as an example for changing pedagogical design to better engage learners in design thinking. Donar (2011)

surveyed five different design thinking courses in across various disciplines to compare course structure. What emerged from the review is the variety of ways design thinking is interpreted and applied. Authentic assessment, thinking through making, group feedback, and self-reflection play significant roles in many of the teaching-related articles consulted.

Hands-On Design in Context

In examining the impact of a hands-on design approach on students' design thinking, a design course (Felt Construction) is explored. First, however, the larger context within which the course exists is examined. This three credit professional elective is offered within the context of a school of architecture and design whose founders were students of the Bauhaus faculty. The Bauhaus School is widely recognized for its interdisciplinary, hands-on approach to design, and for its revolutionary stance on the partnership of craft and industrial production, when mass production was largely seen as a threat to craft and craft production (Simon, 2012). Here, as in a majority of design programs in North American universities today, the design studio is considered the core of design education (Simon, 2012).

First year students are enrolled in a general design studio course with their colleagues from other design majors. This interdisciplinary approach to the design studio is based on the model of the Vorkurs (introductory course) taught at the Bauhaus (Simon, 2012), and it underscores the philosophy that all design disciplines share a common language of design elements and principles. With this common foundation, students move into their respective disciplinary programs in the second year. The Foundation Design Lab is described in the course catalog as "an immersive, interactive learning environment focused on inquiry, experimentation, discovery, and synthesis." The emphasis on these modes of learning remains a hallmark of the studio throughout the undergraduate curriculum.

This general Foundation Design Lab course has much in common with the specialized studio-based, material-focused course (Felt Construction) under examination—critiques, exercises, projects, and prompts. *Critiques* are formal or informal discussions about student work that is displayed as a visual presentation or a physical model. The "desk crit" began as an over-the-desk, one-on-one give-and-take between student and instructor in architecture programs in North America, reflecting Dewey's ideas of the teacher as an active partner in the learning process (Anthony, 2012). The definition of critique has expanded from there to include dialogue in groups. Generally, both students and the instructor participate in the discussion, with the

objective of revealing strengths and weaknesses in the work for the purpose of advancing the work. This format meets the criteria for authentic assessment as defined by Wiggins (1990) and Keyser and Howell (2008). In Felt Construction, students are given shorter-term exercises, and longer-term projects, the products of which are often critiqued and improved upon through iteration. Often the exercise or project is initiated through a prompt provided by the instructor. Another term commonly used is *brief* (Cassim, 2013; Goldschmidt & Rodgers, 2013; Hatchuel & Weil, 2009; Razzouk & Shute, 2012). The term *prompt* is meant to convey the open-ended nature of the exercise or project; rather than being asked to design a specific product, the prompt may define the desired characteristics or effects of a design, and will leave it up to the student to decide how best to achieve that outcome. From these few examples, one can begin to deduce that self-direction, reflection, and the capacity to communicate ideas are traits that are cultivated and esteemed in design students.

Within the context of a studio-based curriculum where interdisciplinary collaboration is valued and recognized as a necessary reality of today's work environment, a course known as Felt Construction is offered. The Felt Construction course is open to all design majors and all year levels. As a material-based elective, this course serves as a forum for students from the various disciplines to work together and to abandon preconceived notions of discipline-specific roles through the focus on the material. Because so few students are familiar with felt, the playing field is leveled and every student enters as a novice.

Why Felt?

Felt is an ancient, elegantly simple, and versatile material that has enjoyed a popularity explosion across the design fields in recent decades. From furniture and accessories to fashion and interiors, felt is sought after because of its tactile appeal and sustainability. A non-woven material made from wool, it is a fabric, yet it can be manufactured in densities reminiscent of plywood or other sheet materials used in construction today. While felt has enjoyed a renaissance among the design professions, there is still much untapped potential in the material.

Felt has been used for decades in industrial applications where it is valued for its durability, wicking, insulating, and liquid- and sound-absorbing properties, to name a few. In the United States, the Society of Automotive Engineers has rated felts according to density and other properties, ranking their suitability for specific uses and creating a system of standards that insures a reliable, narrowly defined profile (Dent, 2009).

Felt Construction: Pedagogy and Course Structure

This course has three over-arching goals: (a) building a new awareness about felt, (b) gaining an appreciation of felt's potential, and (c) creating a more effective dialogue between students' ideas and the physical felt-based artifacts they make. Knowledge of materials and an effective negotiation between ideas about form and the realities of constructing that form are powerful tools in the pursuit of excellence in design and lead to increased student agency. Indeed, the course is constructed around the value of primary experiences with physical materials for students who are learning to design the constructed environment. In *The Craftsman*, Richard Sennett (2008) wrote about the hand as a thinking tool and evoked the workshop and the laboratory as arenas of heuristic learning. He argued that iterative and hands-on practice of any vocation or craft is a singular learning experience and is a potential source of deep satisfaction for the individual engaged in such work (Sennett, 2008). Felt Construction is designed to provide a learning environment that links the head, the hand, and the material (i.e., felt) in an effective dialogue. As Sennett (2008) wrote, "Every good craftsman conducts a dialogue between concrete practices and thinking; this dialogue evolves into sustaining habits, and these habits establish a rhythm between problem solving and problem finding" (p. 9); that is, thinking through making is an important tool for cultivating habits in students that make them more effective learners, with the ultimate goal being that they not only find the best solutions to problems but that they ask better questions of themselves and their environment. This echoes Schön's (1983) discussion of problem-solving versus problem-setting. According to Schön (1983), the act of framing a situation, or defining the problem to be solved, is essential to design thinking. By doing this, designers open up new avenues of exploration through which to generate solutions. Also implicit in Sennett's (2008) formulation is the idea of tacit knowledge, wherein practice transforms the novice into an expert, and the technique becomes unconscious, leaving the goal or desired outcome as the sole focus.

The course itself consists of five elements: (a) course introduction, (b) precedent research, (c) hands-on technical workshops, (d) exhibit challenge, and (e) independent student project. Because of the interactive, intensive hands-on nature of the course, class size is limited to 14 students. This also ensures that the equipment and facilities will not be overwhelmed and that each student can receive one-on-one assistance with technical aspects of the course.

Built into the course are several ways of conveying new information to students. On the first day of class, students are provided with as complete a picture of the course-based learning experience as possible: syllabus, schedule, types of assignments, expected time commitment, grading, expenses for materials, and other logistics. Physical samples accompany a narrated PowerPoint presentation consisting of words and images. Bower (2011) cited studies in multimedia learning to support the idea that content presented in visual and auditory mode can lead to more effective learning. Students are asked to work in a variety of media throughout the semester. The mix of media and formats accommodates diverse learning approaches, providing more avenues for accessing and processing information. The class is launched with the assignment of precedent research and an overview of upcoming technical workshops. The importance of student engagement and initiative to the success of the course is emphasized. The prompt for the exhibit project is generally distributed during the second or third week.

Because the majority of students are in their junior or senior years, they come with a developed sense of their design process and a familiarity with studio practices that they bring to the course as a way of confronting an unfamiliar material. Over the years, the course has evolved to balance shorter-term exercises with longer-term projects, individual work with group activities, and technical challenges with opportunities to integrate conceptual direction and new skills. Each year, close attention is paid to the level of student engagement at each stage of the process, and student input is solicited at key points. Using two different iterations of Felt Construction, the evolution of the course model over time and the relevance to instruction in any field in which students will have a role in determining the physical manifestation of an idea will be illustrated.

Case Study: Big Felt

In the semester immediately following the set up of a new Felt Lab that supports the fabrication of large-scale pieces of handmade felt, course design was focused to take advantage of the new space and equipment through the theme *Big Felt*. The curator of a gallery space on campus was approached with a proposal for a collaborative felt exhibit that acts as a full-scale, site-specific installation. The description below frames the exhibit for viewers:

> *BIG FELT: Collaging Interiors* is an assemblage of highly tactile, interactive, site-specific spatial constructs designed and fabricated by students in the Felt Construction course. The work seeks to explore the limits of felt as a building material while considering how felt might mediate the relationship between the built environment and the human occupant. Students have created works tailored to the gallery space responding to the

temporary nature of the setting and questioning the traditional protocol for interacting with art in a gallery. The installations vary from humorous to provocative and invite participants to think about the role of felt in shaping space.

The cohort included architecture, interior design and industrial design majors or minors. Students were asked to choose from a list of suggested topics for both the precedent research and the student-led workshop assignments. Because of the ambitious scope of the exhibit, independent student projects were not included in the course this semester. Students were given the prompts for precedent research and student-led workshops in the first week, and the exhibit prompt was distributed in the third week.

The deliverable for the precedent research is a maximum 10-minute PowerPoint presentation, which the student presents to the class. The presentations efficiently build a student's background knowledge of the material properties, historical background and contemporary applications of felt by pooling the research efforts of the group. This involves students in co-creating knowledge and building their learning environment, aligning with a model of learner-centered pedagogy where the teacher acts as a facilitator (Dowling, 2012; Scheer, Noweski, & Meinel, 2012).

In week three of the semester, students were given a written prompt, which included the description of the exhibit above as well as language evoking different types of temporary interiors. Because the prompt outlines abstract concepts rather than providing more concrete parameters for the project, this can be considered an ill-structured problem. Students are therefore obligated to add their own parameters—an act of framing— to allow them to proceed. They were asked to brainstorm and bring in sketches for critique. As ideas were proposed and discussed in an informal group setting, three imperatives were emphasized by the instructor: (a) the interactive nature of the exhibit, (b) the cohesiveness of the exhibit as an interior environment, and (c) the focus on felt as a spatial medium. In response, students put forward ideas for the organization and character of the whole space as well as for their individual contributions.

Students were also asked to select from a list of technical workshops (or suggest alternates) and run the workshop (individually or as a team) with guidance from the instructor. Examples of typical workshops are fabric manipulation (shaping industrial felt by sewing) and hand felting (making felt from raw fleece or prepared wool). Some students wanted to wait until the class had agreed upon a design direction for the exhibit before choosing a workshop. As they saw it, the workshops should be in service of the final product. As it happened, workshops that were conducted early, such

as the structure/enclosure and texture workshops (both themes suggested by students rather than selected from the list) were generative, and this led to students forming teams around like interests. In a few cases, these workshop teams translated directly into exhibit teams. These subgroups provided a narrowed focus and feedback for each student's contribution to the exhibit. Once these teams emerged, small group critiques were alternated with large group critiques, to ensure that there would be a cohesive collective vision for the show as well as smaller areas or groups of objects with distinct themes. Two such groups yielded particularly strong work. In the case of the Texture Wall/Panel group, individuals designed and fabricated their own pieces, but they collectively agreed upon the way the whole group would be displayed. The Fiber Forest group took a different approach; together they designed a modular component, a felt cone whose structure was provided by a specific type of seam, and each student participated in the fabrication and deployment of the scaled multiples of the module.

The Exhibit: The Dynamic Curtain

The display organized by the Texture Panel group served to illustrate the collectively negotiated parameters and the individual expressions created within that framework. Together, the students chose to create a "gateway" to the show, hanging panels at varying heights and depths across the width of the gallery space, suggesting a thickened but porous wall on the one hand and an assembly of individual pieces with distinct identities on the other (see Figure 1). In the case of the leftmost panel, the student's design was directly related in form and technique to her own research and to the work of a designer that was introduced by the instructor. The student began with intentions to highlight the softness and translucent quality possible in handmade felt while creating a plane that branched out into a three-dimensional surface, capturing space within it. The final construction of the piece involved negotiation between technique and concept to reach the result that best embodied these intentions. The final panel, back-lit and overlapping with its red neighbor, displays the modulation in thickness of the handmade felt created by the layering of felt strips that had been hand-stitched together. Also highlighted are the variation of thickness and surface texture within each handmade strip.

The next piece is the most ambitious piece in terms of scale. Titled "Dancing on Red," the panel measured 7 ft x 10 ft and was composed of wool that was batch dyed several different shades of red and layered in a randomized pattern to create gradation. This piece pushed the limits of thinness, revealing the webbing of wool fibers. This was the only panel of the four that met

Figure 1
Texture Wall/Panel Group, Demonstrating Cohesive Vision and Individual Identity

the floor and piled in a manner reminiscent of Robert Morris' pieces, a subject of the students' precedent research.

Across the opening, "Tile Expectations 1" combined dyed handmade felt and undyed industrial felt, which were connected using techniques that are a cross between the overlapping of siding and seaming techniques used in sewing of upholstery and quilts.

"Shadow Pockets" is the final piece to the extreme right. The form of the triangular scoop-shaped unit emerged first in this student's design process and drove the composition of the whole. The units of the screen created and captured light and shadow in a visually compelling manner. The proportion of positive to negative space in this panel created a direct visual connection between the spaces on either side, while partially framing and filtering that view. The ensemble of the four panels demonstrated the use of felt as a spatial divider, a screen, and a filter with the flexibility of the curtain.

The Exhibit: Mobile Cones

In the Mobile Cone group, all aspects of the design fabrication process were collaborative, resulting in an entirely unified exhibit display. The three students interested in developing modular components made of industrial felt worked on developing a seamed, tapered cone that would stand independent of external structure and could be assembled in large numbers to shape an environment (see Figure 2). The final design purposefully approached the slenderness ratio that would cause the pieces to tumble over. "Fiber Forest" had undeniable appeal for adults as well as children, but visitors under age 12 were the most uninhibited in their

engagement with the moveable felt elements. Several visitor-constructed variations were recorded throughout the one-week duration of the exhibit, each revealing some new characteristic of the cones as space-making components.

Reflecting on Big Felt

This iteration of Felt Construction was evaluated through dialogue with students and colleagues after installation by watching gallery visitors interact with the pieces and through instructor reflection. User interactions with the environments created gave the students an opportunity to experience user feedback. The quality of the finished work served as evidence that over-arching pedagogical goals were being met, but room for improvement was also identified. The first two Texture Wall/Panel exhibit pieces clearly demonstrated the value of the precedent research, hand felting and wool dyeing workshops. Knowledge construction through hands-on workshops and exposure to the work of other designers provided the necessary impetus, technical skill, and inspiration to envision and successfully implement a design that met the criteria of the prompt. The challenges in this iteration of Felt Construction arose in the sequencing of exercises, workshops, and projects; the balance of group to individual work; and the degree of self-directed versus more structured learning that took place. In an informal feedback session at the end of the semester, one student suggested that the workshops, and the hand-felting workshop in particular which played a key role in her exhibit project, be held earlier in the semester. This input and other feedback, combined with my own reflection on the process, led me to make some

Figure 2

Fiber Forest, Demonstrating Collective Vision and Implementation of a Modular Design and Its Interactive Appeal

structural changes in the next iteration of the course. Bower (2011) emphasized the need for students to understand lower-order processes before design can be effectively learned, and Reboy (1989) cautioned that rudimentary instruction of skills should take place before requiring a student to apply those skills under more challenging circumstances.

Case Study: Felt Frontiers

In this iteration, a significant change was made to the workshop sequence and content delivery. Whereas the sequence and content of these workshops had previously been dependent on student initiative, in Felt Frontiers, workshops were organized and led by the instructor, and they focused on the introduction of specific techniques and skills, each one explored in the manner of a contemporary felt designer. These technical, hands-on workshops were conducted at the beginning of the semester, and they were paired with an assignment to allow students to immediately put their newly acquired skills into practice. Each student was asked to (1) make a physical sample using the techniques introduced in the workshop and (2)

document their making process through images and text in a PDF. This series of steps built analysis and self-reflection into each workshop, as well as an opportunity to apply the newly-acquired skills within a limited scope, calling on the student's ability to synthesize his or her learning. This proved to be a more efficient strategy for accelerating the students' learning. Seitamaa-Hakkarainen and Hakkarainen (2001) compared the design process of novice weavers to expert weavers and found that the major difference in their approaches was that the novices focused on the visual composition of the textile while the experts moved back and forth between construction of the design and the formal composition, developing the two in tandem. As the technical workshops were structured to include both precedent examples and hands-on, heuristic tasks, students were able to build a larger repertoire of previous experience to draw from as they confronted the exhibit project.

The Exhibit: Modular Felt Panels

The exhibit for Felt Frontiers was held in a display space in the architecture building. Students were given a

written prompt and a drawing of an oak frame to be fabricated. Each student was asked to design and fabricate four 2 ft x 2 ft modular panels exploring how felt might be used to sculpt surfaces and how the panels might be used to shape an interior. The drawing specified the construction of the frame to be incorporated into the design, including dimensions and the options for attachment to the wall, floor or ceiling. As in the case of Big Felt, some parameters of the project were defined for the students, but the openness of the exercise required students to further frame the problem in order to act. The choice of scale and parameters for this project were a counterpoint to the ambitious scale and freedom of Big Felt. The Modular Felt Panel project prescribed the size and number of artifacts that students were asked to make. While the groups brought cohesion to the Big Felt exhibit, they also delayed action and decision-making. In order to build the cohesion into the Modular Felt Panel project, the size and approximate purpose of the module were dictated. In contrast to the highly choreographed and pre-designed layout of the Big Felt exhibit, the layout of the Modular Felt Panel exhibit developed organically on the day of installation. The instructor had mapped out zones for attachment of the modular felt panels, but not individual pieces. Students arrived at the appointed time with their completed panels, and a negotiation began to determine the best groupings of pieces and the most impactful way to present the panels as a surface. After an open debate among the students, a unifying grid was agreed upon, with different spacing to separate compatible subgroups or to identify the work of one individual. Ultimately, the system had enough flexibility built into it to accommodate student preferences regarding the proximity and context of the pieces without diminishing the overall desired effect of a larger felt surface.

The direct translation from the workshop samples to the panel exhibit design was very clear in this iteration of the course. Students used techniques they learned and enjoyed or found intriguing, applying those to the larger-scale project. One student made four different panels, each building on a different technique learned in the workshops (see Figure 3). This student's work effectively demonstrates a mastery of techniques and the synthesis of numerous variables to achieve a conceptual goal.

## Summary Reflection and Future Directions

Reflecting on the two case studies was useful in identifying the most effective instructional methods for supporting student discovery given the course structure and content. The case studies suggest that the learning of new technical skills is more effective when separated from the application of those skills in a larger ill-structured project. This observation is supported by the

literature, as mentioned earlier (Bower, 2011; Reboy, 1989). The quality of the outcomes for the workshop PDFs and samples in the second course iteration provide a compelling argument for the advantages of building reflection into this course at more frequent intervals. Because much of the information and many of the experiences are new, asking students to reflect and make sense of their experience appears to support productive knowledge building. While group collaboration imparted unity to the designs in Big Felt, students seem to be more comfortable with the indeterminacy of the project when the relationship of group work to individual work is more explicitly defined. This suggests that close attention must be paid to the balance of ill-structured and well-structured tasks included in lesson plans in order to enable student learning.

To reiterate, the five-part structure of the course scaffolds a series of design-thinking activities (e.g., reflection, prototyping, sketching) and learner-centered interactions (e.g., critiques, peer feedback, collaborative decision-making). Each element fosters design thinking and contributes to the effectiveness of the hands-on learning model in enabling students to develop new knowledge and to practice design thinking. The first course element, the course introduction, allows the instructor to model design behavior by providing students with a broad overview (i.e., systems or holistic thinking) through a multi-modal presentation. The workshops have been refined to include an assignment asking students to record their process and present it in words and photographs organized in a PDF file. This builds both reflection-in-action and reflection after-the-fact into the workshop activity. The physical sample created allows students to practice non-verbal modes of cognition, or thinking through making, also cited in the literature as important processes in design thinking (e.g., Cross, 1982; Dörner, 1999).

The reshaping of the Felt Construction course each semester is another example of the process of design thinking or reflection-in-action. Assignments have been refined and changes have been made to the course structure that provide opportunities for students to (a) use previous knowledge to connect to new information, (b) reflect on the value of new knowledge, and (c) bring new competencies to bear in a process that involves framing of a problem and negotiating between ideas and constructing form. The following question continues to guide instructional design: What is the ideal balance between theory and practice, or between freedom and structure, given the unique opportunity that presents itself each semester? Based on instructor observations, reflections and student feedback, goals for future iterations of the course include incorporating opportunities for students to benefit from user feedback and developing assessment tools that help instructor and student alike gauge the effective learning of design thinking traits.
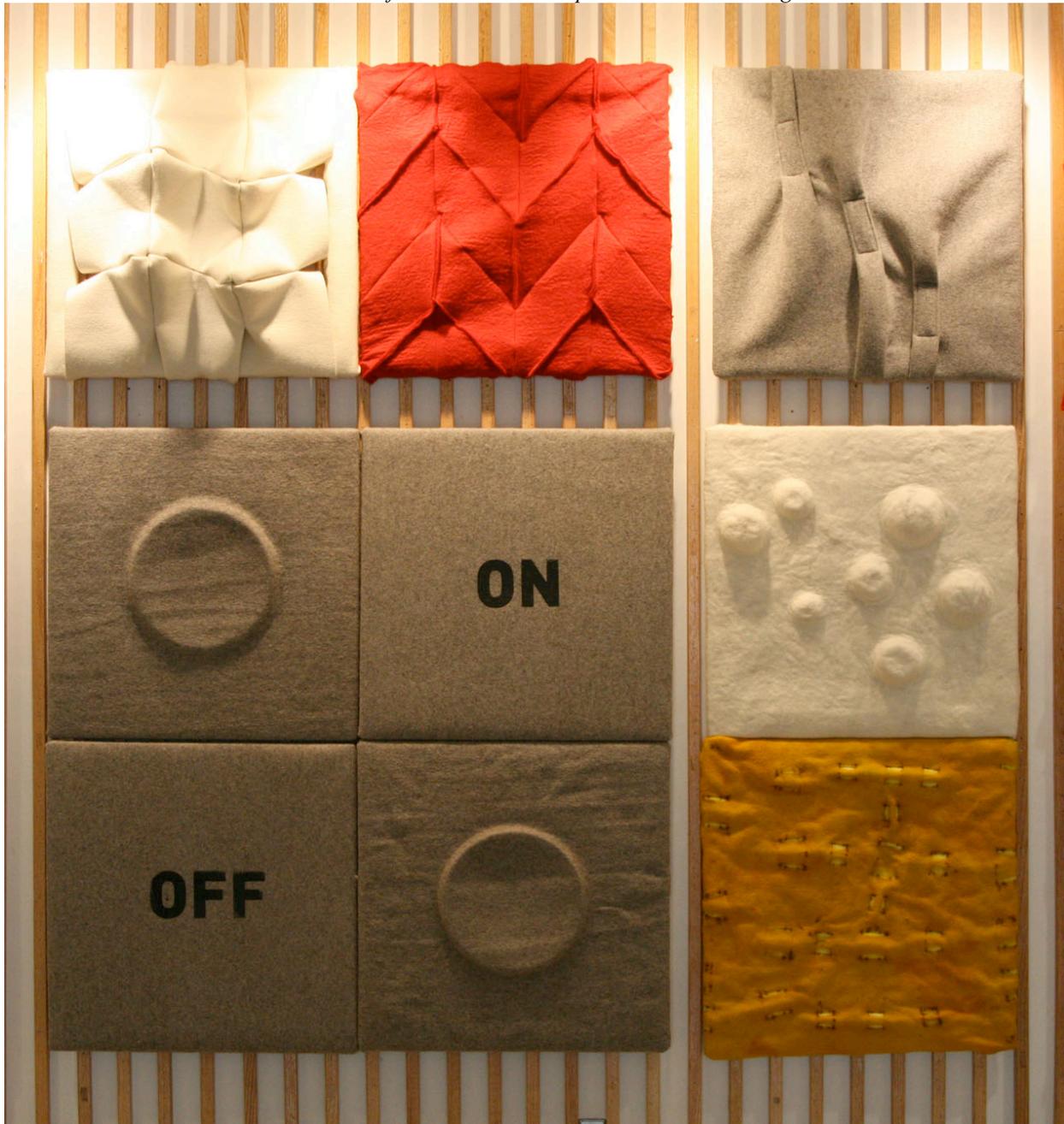
Note. Upper left panel and panels in right hand column are the work of one student, demonstrating the application of techniques learned in the fabric manipulation, 3D forming, and felt dyeing workshops.

A Design Thinking Learning Model

There is a growing popularity of design thinking in fields as diverse as IT, business, education and medicine (Dorst, 2011), and design is practiced in a widening domain (Cassim, 2013). While there appears to be general consensus on the value of design thinking as a 21st century skill (Scheer et al., 2012), a review of the literature also suggests the need for more research that can provide practical guidelines to higher education instructors across disciplines for the effective incorporation of design

thinking into course design (Reboy, 1989; Scheer et al., 2012).

Teal (2010) and Reboy (1989) highlighted patterns in Western education that prove to be obstacles to design thinking as a way of knowing. Teal (2010) pointed out the difficulty for students who have been educated in a system founded in the scientific method and representational thinking in adopting a non-linear model of learning. Reboy (1989) asserted that problems presented in programs for training critical thinking tend to be well structured, in contrast with everyday problems that tend to be ill-structured. Another important consideration in the successful support of design activities is the need to encourage experimentation and acknowledge failure as an important heuristic learning tool.

In this article, a studio-based, hands-on, material-focused learning model has been examined through case studies and in the context of recent scholarship on the topics of design thinking, design process, and studio culture. The core principles upon which this model is based are hands-on learning and thinking through making. It has been demonstrated how the five elements of the course structure set the stage for activities that have been identified in the literature as critical parts of the design process: reflection, sketching, and modeling as non-verbal modes of cognition and iteration. The activities that support idea development throughout the course are critiques, peer feedback, and collaborative decision-making. While the five elements of the course structure have helped establish a pattern of making, reflection, peer feedback, and the application of newly acquired skills to ill-structured problems in the Felt Construction course, the author is suggesting that instructors adapt the model to the content and unique circumstances of his/her course. In other words, it is proposed that the model will be most effective when applied with a design thinking mindset. The instructor can evaluate the elements of the course, the pedagogical goals they serve, and the behaviors or experiences they foster to better align his/her course objectives with the appropriate instructional devices. As stated in Dowling's (2012) review of experiential learning, it is important for course design to accommodate unexpected situations that arise, including the needs of students and instructor improvisations. This proposal challenges educators to engage in design thinking alongside their students, acting as an active partner in student learning, in the tradition of Dewey (1938). In this spirit, a learning environment can be created that will cultivate design thinking in students across disciplines and curricula.

Conclusion: From Felt Construction to Mind Construction

As Peter Rowe asserted, "design is a way of thinking about and knowing the world" (p. 245), and it is this type of knowing and mental agility that will prepare future professionals to confront and even help determine the shape of the future. Design thinking and the design process are intrinsically flexible and adaptable, drawing on and developing a student's capacity to frame opportunities for change and to bring form to ideas for the purpose of improving the human condition. Design problems require subjective interpretation (Lawson, 1990) and an ability to cope with uncertainty (Cross, 2011). Practicing design thinking develops in students the ability to navigate undefined territory and to act on their environments to bring about change. Higher order thinking skills such as design thinking enable students to analyze, synthesize and innovate, and thus to deal with real-world problems (Razzouk & Shute, 2012). Providing students in higher education with opportunities to develop these traits and capacities can empower them to engage in today's complex, global society and determine its form in the future.

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Lab Reports: A Concise Guide for Non-Native English Speakers

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College students in the non-English-speaking world have to overcome formidable barriers in reading and writing when their medium of instruction is English. One particular problem faced by science majors is the writing of lab reports, a demanding task that might not be effectively supported by the standard guides and manuals available. This paper presents a new, very basic, no-frills guide aimed specifically at students in countries where English, although a second language, is also the language of instruction. The purpose of the guide is to provide an explicit structure to assist the user in presenting and communicating information in a clear and logical manner.

College students in the sciences are usually required to write laboratory reports as part of any practical course they may take in their program of study, whether in the life sciences, physical sciences, or social sciences. The importance of this ubiquitous writing assignment cannot be underestimated. Not only does it allow the students to organize and present their lab work in a standard, coherent framework, but it also forms the basis for future scientific writing in a format instantly recognizable by and acceptable to other scientists across the globe.

Mastery of the required form and content of the lab report is therefore a critical skill for nearly all science students, and it is acquired gradually as students move from lab course to lab course throughout their career. Additionally, senior students may have the opportunity to carry out original research or be involved in assisting faculty research. In either case, experience and expertise in scientific writing (i.e., lab reports) would be invaluable for their projects. While other types of scientific writing (e.g., science notebooks and persuasive articles) may also be encouraged, the lab report endures as the principal end-product of practical science teaching in most countries.

Teaching students to write according to the requirements of scientific reporting is not always an easy task (Schulte, 2003). Instruction in writing lab reports is usually provided in varying degrees of expertness by lab instructors and teaching assistants. In addition, students are referred to supplementary guides and manuals. These range from highly respected tomes such as the *Publication Manual of the American Psychological Association* (American Psychological Association, 2009) to a motley collection of more concise guides freely available on the Internet (e.g., Bates College, 2002; UniLearning, 2000).

These guides invariably describe the IMRAD (introduction, methods, results, and discussion) structure, giving an account of each section in some detail, explaining the why and wherefore of the structure (e.g., the funnel shape of the introduction), and sometimes providing examples of the type of information that needs to be included or omitted. Many

guides suggest questions the writer should be asking in each section (e.g., "What background information exists on the subject?"). Instructions on appropriate style and language usage (e.g., tense, voice) may also be included. In general, the salutary aim appears to be not only to instruct the aspiring writer in the mere mechanics of report writing, but to also promote higher-level thinking and reflection.

Problems for Non-Native English Speakers

However, while these guides are more than satisfactory for the needs of the average English-speaking science student (although anecdotal evidence suggests that they are much less referred to than brief, informal handouts from lab instructors), it is not often noted that they are relatively impenetrable to students across the world for whom English is a second language.

These students often live in post-colonial countries where English is the medium of education, usually at secondary and tertiary level. As Probyn (2006) described the situation in many schools in South Africa, the students' first language, or "home" language, is used for all communication outside the classroom, and sometimes even for discussion within the class, especially if the lecturer shares the same language. Thus, while the students are functionally fluent in the English used within the classroom, they tend not to use English in any other natural context of their lives, and it remains very much a foreign language. For most, then, not only do they have the ordinary challenge of learning their subject matter, but they also have to do so in spite of formidable linguistic barriers (Probyn, 2006). Focusing on the latter leaves less cognitive processing for achieving the former.

It should be understood that students in these countries are as bright, as motivated and as hard working as their counterparts in the English-speaking world. They have similar aspirations, the same need to do well in their coursework and the same need to develop their skills in scientific writing. But unlike most of their English-speaking colleagues, they face a

number of additional hurdles to reach their goals. From primary and secondary school onwards, they may have been struggling with poor facilities and under-equipped classrooms and labs. At college level, it is likely that they have few textbooks and meager, outdated library resources, as well as limited facilities for accessing online material (Bunoti, 2011). To top it all, they have to study (read, write, achieve) in a foreign language.

Writing skills in general tend to be poor in these situations. For example, Fatima (2012) highlighted problems in writing faced by college students in Pakistan, while those faced by Arab post-graduate students in Malaysia were described by Al-Khasawneh (2010). Scientific writing such as the lab report is often found to be a particularly difficult assignment. For example, McLaren and Webber (2009) noted the poor quality of scientific writing of undergraduate science majors in Jamaica. In fact, Cameron et al. (2009) estimated that difficulties in scientific writing faced by second-language English speakers are "four or five times as much" (p. 510) as those faced by native English speakers. Apart from linguistic barriers, there is the problem of few prior opportunities for scientific writing. Scarce college resources frequently do not allow for lab classes until senior-undergraduate or even postgraduate level, when students are suddenly faced with the requirement to write a lab report. Novice researchers can have particular difficulties in scientific writing (Shah, Shah, & Pietrobon, 2009), and indeed, prior experience has been highlighted as one of the most important factors for successful report writing (Jerde & Taper, 2004).

Thus, science students in non-English-speaking countries who are studying in English can face enormous difficulties in developing the skills critical for scientific writing, and as such, are handicapped in achieving their immediate goals of academic progress as well as their future career development as scientists.

A New Guide for Writing Lab Reports

The purpose of this paper is to present a practical guide to the basics of lab report writing, aimed at undergraduate (or inexperienced postgraduate) students in non-English-speaking countries, where English is the medium of instruction. It could even be helpful for English-speaking students who need extra assistance in writing their lab reports.

Writing a good lab report requires mastery of both its structure and its content. The proposed guide (see Appendix) offers support mainly in structural aspects. This means that cognitive resources can be diverted from struggling with nuts-and-bolts-level information (the basic format of the report, what must be included in each section) to focusing on the content of the report (higher-level understanding and reflection). It might be

noted that several aspects of an explicit structure (e.g., sequential steps of the introduction) could be helpful in prompting the logical organization of thoughts and arguments as well.

The proposed guide takes a very basic, no frills approach and gives the student clear directions at every step, along with illustrative examples. This reflects the call for instructors to make their expectations for student writing in the sciences "explicit and accessible" (Cabral & Tavares, 2002, Implications of the Study section, para. 3). It was felt that, in the beginning, students would benefit more from direct instructions (e.g., "State two reasons why your study is important") than from a description of the funnel-shaped structure of the Introduction. Further, examples are largely in the form of sentence stems (e.g., "These findings suggest strongly that . . .") that could also act as prompts for writing. This reflects Webb's (2009) use of writing frames to scaffold the scientific arguments of students in South Africa. The examples also provide models of appropriate language and type of usage required.

A pilot implementation of this guide at the University of Dodoma, Tanzania, yielded positive feedback from undergraduate users carrying out a lab assignment on Plant Ecology. Each student was given a copy of the guide to refer to and, after handing in the completed assignment, was asked to fill out a feedback form.

All 25 students who completed the feedback form seemed to have actually referred to the guide, which was an encouraging sign. Ratings on a 5-point "helpfulness" scale (ranging from 1, *not at all helpful*, to 5, *very helpful*) yielded means of 4.7 and above for each sub-section of the guide as well as for the guide overall.

In addition, about half of the students (12) said that they had referred to another lab report guide, either for writing this assignment or in the past. Of these, a majority (eight students, or 67%) said that the new guide was better, while three (25%) said that both guides were similar. Only one student preferred the other guide. Further written comments from the students indicated reasons for liking the new guide. These included "better and more easy to use," plus that "it directs specifically what should appear in each section."

It would therefore seem that the present guide has some measure of credibility and acceptability in at least one sample of its target user group – science undergraduates whose first language is not English.

Description of the Guide

While there is a complete version of the guide in the Appendix, what follows here is a brief description of each section, along with its rationale and practical

application. Interested teachers might find this helpful when using the guide, and also when finding it necessary to make modifications for their discipline and/or course requirements.

Abstract. Here the guide instructs students how to summarize the entire study in six sentences, leading to a terse condensation that covers the study question, methodology, key results and implications.

Introduction. The Introduction, of course, provides the context or background story to the study. It is often described as ideally following a funnel shape, beginning with the broad topic of study, and narrowing down, via relevant research, to the hypotheses of the experiment or study being carried out.

The guide takes students through the general-to-specific structure in six paragraphs, with each successive paragraph taking another step of increasing specificity. For example, the first paragraph deals with the general topic area, while the second takes on the sub-topic area. By paragraph 5, this has narrowed down to "your study—reasons for doing it," rounding off with paragraph 6, "your study—expected results, and why they are important." While six paragraphs with prescribed content might be considered overly simplistic or formulaic, the advantages are that it can immediately assist students in ordering their thoughts and notes into a logical progression, and perhaps even further their understanding of how their study fits in with other research and the larger underlying topic.

The student is instructed clearly at each step as to what is required. For example, in paragraph 3, "sub-topic area—research," the student is asked to "write two or three sentences" to describe each of three other relevant studies, including their important/interesting findings. Again, this might be considered formulaic, but on the other hand, it strongly encourages the student to actually locate and summarise at least three primary sources.

In addition to the direct instructions, side-by-side examples offer further inducement to write, in a "see, this is how it might be done" form of encouragement.

Methods. The Methods section describes the procedural aspects of the study. Unlike other sections of a lab report, this usually has clearly demarcated subsections (e.g., Materials), varying slightly by discipline. However, the guide again provides explicit instructions and examples for each subsection.

While six subsections are suggested, relevant ones may need to be selected by the lab instructor. For example, lab reports in Psychology might omit statistical tests, while non-field studies may not require the "study site" subsection.

In the "note to lecturers" at the end of the guide, it is suggested that further input from the teacher for the design subsection might be highly beneficial, as experience shows this to be one of the most common points of weakness in the reporting of a study. A clear understanding of the design will not only aid students in writing the Methods section, but should ideally clarify their perceptions of how the design relates to their hypotheses and how both design and hypotheses relate back to the overall question. A firm grasp of this underlying rationale would aid the eventual structural integrity of the report, with relevant connections made from the Introduction right through to the Discussion.

Results. For the Results section, the guide first presents, with little explanation, a sample table and graph, on the assumption that a careful copy of the format shown (e.g., placement of title, use of horizontal lines in table) will yield better illustrations than written instructions, especially for non-native English speakers. The guide then instructs students to describe, in a paragraph each, the important and interesting findings shown in the table and/or graph.

Discussion. From the point of view of the students, the Discussion section might be the most mystifying section of the lab report, and it often turns out to be overly focused on one or another aspect of the results of the study. The guide suggests that the Discussion be written in four paragraphs, to ensure a more even coverage of the standard content of matching results to hypotheses/expectations and noting implications, comparing with prior research, making an evaluation, and offering suggestions for future research.

The instructions also make backward links to specific paragraphs of the Introduction, to remind the students where, for example, relevant prior research has been described. These connections are intended to facilitate greater unity of thought across the report.

References. As in the Results section, it was felt that modelling the appropriate format of reference entries for a journal article, a book and an Internet report would be more immediately helpful than a verbal description of the underlying scheme.

Notes. The guide ends with two pages of notes. The first is a page of five general notes marked as important for the student. These cover a suggested order of writing (e.g., the Abstract is generally written last), plagiarism (with a brief suggestion on how to write in one's own words), the use of quotations (don't), and encouragement, when the student is ready, to deviate from the guide as well as to refer to standard publication manuals. The second page of notes is for the lecturer (as mentioned above in the description of the Methods section), and these simply suggest that many students would benefit from further support and clarification with respect to the hypotheses and design of the individual study, in turn leading to a better report overall.

Conclusion

It is clear that this basic guide is not without potential problems. In its present form, it is more

suitable for students in the biological and social sciences, although lecturers in the physical sciences could offer supplementary instructions to their students. Another potential problem is that all the students in the class could end up having very similar (although not identical) reports, down to the same number of paragraphs and sentences. However, this may be something that is quickly overcome as more assignments are completed and the students gain confidence in deviating from the original instructions.

It might also be argued that this type of guide does the students' work for the, and lowers expectations and educational standards. However, it should be clear from the points made above that the targeted population of students may just need a little extra scaffolding than more privileged students when it comes to writing formal lab reports. It could be argued that students sometimes cannot scale the ladder of success if the bottom rungs are missing, and it is this gap that the proposed guide intends to fill.

Students following the simple steps of this basic guide should be able to complete a conventional lab report assignment. This will likely be followed by a sense of achievement and increased confidence in doing the exercise successfully the next time around. Repeated occasions would then lead to familiarity and ease with the basic report structure and the most important requirements. Ideally it would also lead to a sense of dissatisfaction with the (necessary) limitations of the guide, encouraging the student to look elsewhere for supplementary information (which is where other, standard guides would come into their own) and be more receptive to their lecturers' corrections and feedback.

In conclusion, it is proposed that this guide would give students a basic toolkit to actually get started on writing their lab reports, instead of defeating them at the very beginning.

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Acknowledgments

Appendix
A Guide for Writing a Scientific Report

Writing a Scientific Report
A practical guide to the basics of scientific writing

L. Soundranayagam

What this guide is about

You have carried out a study, and collected and analysed your data. You now have to write it up for a class assignment, or maybe for publication. Either way, you will have to follow the basic 'lab report' format, with which you may already be familiar.

This format is actually the easiest way to write about your study because the structure is already clearly laid out. It makes sure that all the important parts of the study are covered. And it also makes it easy for other people to read, and to quickly locate the information they want.

The report format is explained below, section by section. Examples appear in red.

Follow the guide carefully, step by step, and very soon your report will be written and ready to go!

Abstract

Here you write a brief summary of the whole study. It is easiest to write this after the rest of the report has been completed.

You can write an abstract in six sentences:

Sentence 1: State the specific question this study investigated.

Sentence 2: State the main methodology used in the study.

Sentences 3 and 4: State the key results (the key results are the ones that directly answer the study question).

Sentences 5 and 6: State the implications of the key results.

Seasonal fluctuations in species detection were . . .
The two populations were observed over . . .
Significant recovery rates were found for . . .
These findings strongly suggest that

Introduction

Here you tell the background story to your study. Your story should move from general to specific—from the general topic area, to more specific areas that other people have researched, and then to your specific study. Overall, it should answer the question—why was your study needed?

You can write an Introduction in six paragraphs.

Paragraph 1: General topic area

Write a few sentences about the general topic area that lies behind your study. Include a few reasons to show why this topic area is interesting or important. As you write, make at least two references to other authors (of research articles or textbooks) who support what you say.

Paragraph 2: Sub-topic area

Write a few sentences about the sub-topic area that is directly relevant to your study.
Emphasize why this area is interesting or important.
Clearly describe any significant controversies or disagreements in this sub-area.

Paragraph 3: Sub-topic area—research

Describe the findings of at least three other studies in this sub-area. Write two or three sentences to describe each study, mentioning their important findings and/or anything interesting about their methodologies.

Paragraph 4: Sub-topic area—conclusions

Write two sentences summarizing the main findings from Paragraph 3. Then describe clearly why further research is needed.

The depletion of forests across the world has caused . . .
This is of particular interest to biologists . . .
. . . as noted by Bhatt (2011) in her review of this topic.
Range contraction of large carnivores has…
This is particularly important as…
However, many ecologists disagree with this finding . . .
A recent study by Andersen and Simic (2012) showed that . . .
Pichler's (1998) new method of detection soon became the . . .
It is clear from these studies that . . .
However, there still seems to be a gap . . .

Paragraph 5: Your study—reasons for doing it

Most studies either use a new methodology to investigate an old question, or use accepted methods to investigate a new question. In a few sentences, link your question (same or new?) and your methodology (same or new?) to the important findings/controversies of Paragraph 2, and the research in Paragraph 3.

> The present study modified the methodology of Katz et al. (2005) to . . .
>
> In this way, the study hopes to address the problem that has . . .

Paragraph 6: Your study—expected results, and why they are important

Write a few sentences about what results you are hoping to get, and what these results would contribute to the topic area.
Make sure to emphasize why your study is important.

> It was expected that small mammals in forested areas would . . .
>
> This information could be critical to the success of conservation efforts . . .

Methods

Here you describe how your study was carried out. It should be so clear that anyone else could read this section and carry out a similar procedure.

You can write this section in four or five paragraphs.

Paragraph 1: Study site (write this paragraph only if your study was a field study)

Identify the location of the study site.
Describe the study site, mentioning the physical characteristics of the site and the season(s) during which the study was carried out. Describe the main vegetation and animal populations, if relevant.

> Observations were made at Lake Gyr, located at . . .
>
> Elevations along the ridge range from . . .
>
> The area is dominated by evergreen forest . . .

Paragraph 2: Organisms studied

Specify the animals or plants under investigation in the study. If relevant, mention the age or sex of the organism studied.

> Only pregnant or lactating female rats were included in . . .

Paragraph 3: Design

State the number of conditions (or groups) in your study, which you are using to answer your question or test your hypothesis.
State the number of samples taken or observations made in each condition (or group).

> Six experimental plots of 2 ha each, along with two control plots of . . .
>
> Traps were deployed for two consecutive days in each . . .

Paragraph 4: Materials

Describe the materials used in the study. Write at least one sentence each to identify and describe any unusual equipment used.

> A sieve with a diameter of 26cm and mesh of 2mm was used . . .
>
> Two EZTrail 643XL remote cameras were . . .

Paragraph 5: Procedure

Describe in some detail the procedure you followed. Do this step by step, in the same order the procedure was actually carried out. It should be clear when and how the observations were made or the samples taken.

> Direct sightings were recorded from 6am to 7pm each day, with…
>
> The sample was then stored at 18C for 6 hours to ensure that . . .

Paragraph 6: Statistical tests

Describe how the data were treated.
State the statistical tests that were used to process and analyze the data.

> Specimens that weighed less than
> 20g were scored 1, while . . .
>
> Differences between the groups
> were tested by a one-way ANOVA
> . . .

Results

Here you present the main results of your analyses (do not show any raw data).

Show the results in clearly labeled tables and graphs. Follow the format of the examples below.

Table 1. Mean number of direct sightings of target species in each grid plot

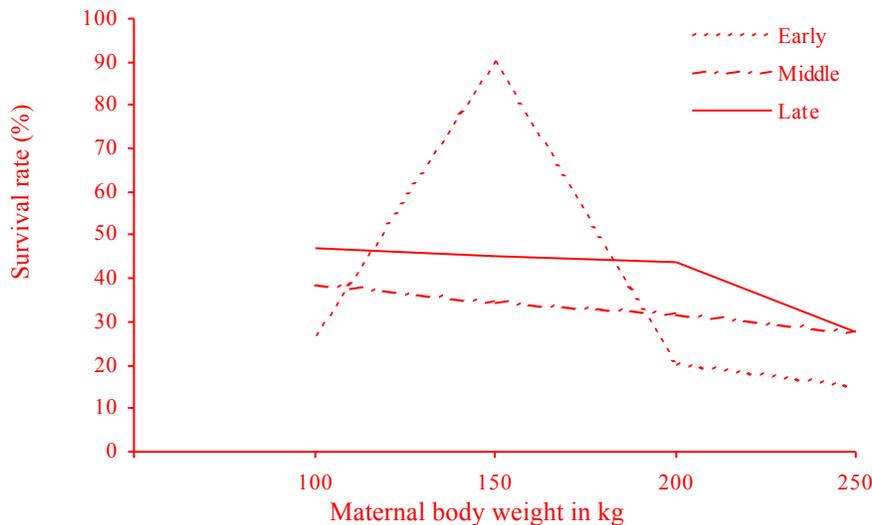| Target species	Plot A	Plot B
Leopard	2	0
Sloth bear	4	7
Jungle Cat	9	3
Common palm civet	0	1
Ruddy mongoose	6	2
Total	21	13

Figure 2. Percentage of early-, middle-, and late-born seal pups surviving as a function of maternal body weight

Write one paragraph for each table and graph to describe anything interesting or important you see in the results.

> Figure 5 shows that fish exposed to
> the highest level of NaCl had the
> lowest body mass ($F_{2, 9} = 10.8$, $p <
> 0.01$) . . .

Discussion

Here you reflect on the results, make interpretations and draw conclusions.

You can write the Discussion in four paragraphs.

Paragraph 1:

What do the results seem to say? Do they match your expectations (as mentioned in the Introduction, Paragraph 6)? What are the implications for the topic area (as mentioned in the Introduction, Paragraph 6)?

Paragraph 2:

Are there any other implications of the data? Do the results agree or disagree with other research in this area (as mentioned in the Introduction, Paragraph 3)?

Paragraph 3:

Make an honest evaluation of the study. Did anything go wrong? Did anything unexpected happen? If you were to run the study again, what improvements would you make?

Paragraph 4:

Based on the findings in this study, can you suggest any further questions that would be interesting to explore?

The clear relationship between day-length and breeding supports the . . .   These results confirm the importance of maintaining forested . . .
Further, the observed response lag suggests that . . .   This agrees with the findings of Varga and Bishop (2006) . . .
One unexpected finding was that . . .   This would need to be monitored in future . . .
This would be a useful tool for further exploration of the . . .

References

Here you list all journal articles, books, websites or other materials you have referred to in this report. Put the list in alphabetical order.

Use the following format for each reference in the list:

Journal article:
Pedersen, L., & Leroy, K. (2002). The impact of habitat fragmentation on songbird diversity in East Africa. *International Journal of Ecology, 12*, 25-32.

Book:
Harris, L. C. (2003). *Animal physiology*. New York, NY: Wiley & Sons.

Internet report:
Angelo, W., & Crieff, J. (2012, June 6). *Species survival*. Retrieved from http://biology.conservation.farnell.edu/301/resource/560/01/

Important!

1. Write the sections in any order that you like. It is often easiest to write the Methods and Results sections first, followed by the Introduction and Discussion, and lastly the Abstract and the Reference sections.

2. The entire report must be written in your own words. Resist the temptation to copy someone else's words, whether from printed material or the Internet--this is called plagiarism, and is unacceptable in the report that you are writing.

Sometimes it can be difficult to write in your own words. The best way to do this is to read the source material very carefully, then close the book or look away, and write it out in your own words.

3. Do not use quotations. These are nearly always unnecessary. Instead, re-write the original material in your own words.

4. As you become more familiar with the format set out in this guide, and with reading other journal articles, you will feel comfortable deviating from this basic structure as needed. For instance, you can vary the number of paragraphs in the Introduction to suit the amount of research in the area and the type of topic you are studying.

5. For more information, refer to a publication manual or the publication guidelines suggested by your lecturer or journal editor.

Note to Lecturers

While this basic guide is intended as a stand-alone manual that students should be able to refer to without requiring additional help, it is suggested that certain sections might benefit from extra clarification with regard to the specific experiment or study being carried out.

Introduction, Paragraph 6: Students might need a little extra help to be completely sure of their hypotheses, and how these relate to the overall question.

Methods, Paragraph 3: Students may need help to understand/remember what exactly the design of the study was, including the number of conditions. They may also need support in understanding how the design relates back to their hypotheses.

Clarity with regard to hypotheses and design would be particularly helpful to ensure the structural integration of the whole report, from the Introduction right through to the Discussion.

Using Video Interaction Guidance to Develop Intrapersonal and Interpersonal Skills in Professional Training for Educational Psychologists

Ben Hayes, Jessica Dewey, and Michelle Sancho
University College London

In this study we assessed the effects of paragraph length on the reading speed and comprehension of students. Students were randomly assigned to one of three groups: short paragraph length (SPL), medium paragraph length (MPL), or long paragraph length (LPL). Students read a 1423 word text on a computer screen formatted to align with their group designation, followed by assessments of content recall, application, and transfer. Results indicate that paragraph length has a significant effect on content application and transfer, but not on content recall. These results are interpreted within the current literature on text comprehension and computer screen eye fatigue.

Video as a Tool to Support Teaching and Learning in Higher Education

The potential value of using video in teaching and learning in higher education has been explored before. Reviews have typically highlighted the high value it can bring as a tool for reflection and development. Berk (2005) noted,

> If faculty are really committed to improving their teaching, a video is one of the best sources of evidence for formative decisions, interpreted either alone or, preferably, with peer input. If the video is used in confidence for this purpose, faculty should decide whether it should be included in their self evaluation or portfolio as a "work sample" for summative decisions. (p. 52)

Video provides a way of reviewing an individual's behavior or performance in intricate detail, making it possible to see things often missed during reflection or even during observation. Detailed analysis allows a person to explore what was effective and what could be improved or developed. Video has been described as a tool for developing the interpersonal skills of students in professional training courses in higher education. Dent and Preece (2002) noted that the use of video to develop clinical skills in medical training was well established over a decade ago. Roter et al. (2004) described the use of video feedback intervention as a way of enhancing patient-physician communication during the first year of training for medical qualifications. Video feedback of simulated interviews was evaluated. The researchers used video coding software to demonstrate that changes in student behaviors took place as a result of a "one hour didactic and role-playing practice session" (Roter et al., 2004, p. 147) based on the four skills areas. Although essentially an exploratory study, the authors argued that "video review is a powerful and effective teaching tool" (Roter et al., 2004, p. 156) and that despite the logistical

difficulties video use can pose they suggest the impact of 2 hours of video work is as positive as much longer communication skills teaching programs.

Video has been used as a tool to model effective teaching. Seago, Mumme, and Branca (2004) developed the *Video Cases for Mathematics Professional Development*. This is a system whereby videos of real classroom teaching are provided on a CD to assist teachers in exploring how to teach linear mathematical functions. Canter and Canter (1976) developed a widely implemented program for supporting teachers with positive behavior management, also based partly on video exemplars that were used in the training sessions. Other examples include Santagata (2009), who explored video use in low performing schools, and Borko, Jacobs, Eiteljorg, and Pittman (2008) who described how video can be used to improve teacher professional development. Borko et al. (2008) used an intervention over a 2-year period where video was integrated into workshop sessions that aimed to problem solve aspects of teaching and learning. The researchers emphasized the notion of a supportive atmosphere in the workshops, and achieving this allowed teachers to talk about video of their own classrooms and video of other teachers more effectively. Interviews with teachers who took part and coding of the dialogue in the workshops showed that over the course of the workshops dialogue focused to a much greater extent on elements of the teaching. Without comparison data it is difficult to be specific about the impact the video itself made, but teacher's perceptions of the power of the video experience were recorded in the interviews.

In a different context, trainee teachers learned classroom management skills, through video feedback to promote positive behavior management (Speidel & Tharp, 1978). More specifically the aim was to increase the rates of positive feedback to pupils in the classroom. The intervention consisted of a lecture, training on identifying specific pupil behaviors, modeling of target behaviors by a demonstration teacher, training on the

use of praise, watching videotaped model situations, guided practice in the classroom (which were videoed) and feedback sessions where the practice session was discussed. There was evidence that trainee teacher behaviors that were the focus of the teaching program (the use of praise in classrooms) increased substantially post intervention and at 5-month follow up. Behaviors that were not the focus of the intervention (e.g., the use of tokens) did not change.

These examples typify how video might generally be used to support teaching and learning. Target behaviors or key elements of effective practice are identified and then taught or modeled. The learners practice to implement the new learning and their attempts are recorded on video. The learners then have the opportunity to see for themselves whether they put their learning into practice, either with or without tutor or peer facilitation and feedback. Although perhaps typical, using video in this way is very different to the VIG methodology that will be described below.

Video enhanced reflective practice is an intervention that incorporates many of the ideas of VIG. As the use of video enhanced reflective practice in HE to support teaching has already been described as a tool for developing the skills of teachers and lecturers in higher education (Cave, Roger, & Young, 2011), it is only briefly introduced here. In this method lecturers and teachers took part in an intervention that involved reviewing video of their actual teaching and video of mock teaching sessions to identify ways to improve learning. The perspective taken being that "what is most significant for student learning is how the interaction is managed and how the teacher communicates with their students, above what the context of the message is" (Cave et al., 2011, p. 184).

VIG differs from other approaches to using video as a tool for learning and development in particular ways. In order to appreciate the differences it is necessary to explore VIG in some detail.

Video Interaction Guidance

Video interaction guidance is well established as an intervention that will improve parent and child relationships and as such is recommended in UK national guidance on children's wellbeing (National Institute for Clinical Excellence, 2012). The process of undertaking VIG involves thee steps: (1) recording video footage of people during normal interactions, (2) analysis of the footage by a trained guider, and (3) a shared review of short clips of the video that the guider selects to explore in detail. These three steps can then be repeated to work on new goals and develop new learning. The process focuses on fine tuned analysis of short video clips, called microanalysis. It also focuses on the quality of the conversation between the VIG guider (the person taking the video and editing it) and his or her client when they look at the video clips together. For full details about delivering VIG see Kennedy, Landor, and Todd (2011).

VIG as a Tool for Developing Relationships

Often used with parents to enhance parent-child relationships (Fukkink, 2008), the intervention has its basis in the ideas of intersubjectivity and attunement (Cross & Kennedy, 2011; Trevarthen, 2011; Trevarthen & Aitken, 2001). Through seeing successful moments of interaction a parent develops greater sensitivity to a child's initiatives in interaction and becomes more attuned to the child's thoughts and feelings at any one point in time. The result of more sensitive parental responses to children's initiatives can be seen in terms of both child and parental well-being (Fukkink, Kennedy, & Todd, 2011).

Although the significance of early experiences makes interventions that focus on mother-infant relationships particularly valuable, there are many adult-child and adult-adult relationships in the professional arena where attunement and sensitivity to another person are vital to the success of the task being undertaken. In the context of psychology, psychiatry, and counseling, the link between intersubjectivity and the therapeutic alliance, sometimes referred to as the working alliance (Clarkson & Porkorny, 1994), is well established, and many writers have explored the ideas that underpin this important feature of a therapeutic relationship.

Ideas associated with the therapeutic alliance include empathy, interpersonal skills or interpersonal intelligence and communication skills. "Almost all would argue that the qualities of warmth, personal congruence, empathy, contact and positive regard are necessary, if not sufficient components of any therapeutic alliance" (Clarkson & Porkorny, 1994, p. 58). There are also clear links with the conceptualization of interpersonal and intrapersonal skills seen in emotional literacy (Goroshit & Hen, 2012). Any professional training in the "helping professions" is likely to include learning that focuses on the development of some of these skills.

Relationships in Higher Education

The importance of relationships and interpersonal skills for effective learning in higher education is well established. For example, Brockbank and McGill (1998) described the task of teaching in higher education as being based on facilitation where learning is a "social and collaborative process" (p. 147) based on the relationship between learners. Here the building blocks required for effective adult learning are

described in great detail, and they include a great variety of interpersonal and intrapersonal skills such as active listening, awareness of posture and maintaining eye contact, as well as more advanced processes such as emotional regulation and empathy (Brockbank & McGill, 1988, p. 208). A key aspect to this relationship is described as *immediacy*. This, Brockbank and McGill (1988) noted, is an idea that relies on the facilitator bringing into focus factors that are present in the relationship in the here and now, and so being mindful of the present.

Some authors have also described this relationship in terms of intersubjectivity. For example, Light and Cox (2001) argued that adult learning in higher education is best facilitated by "what may be called an intersubjective or dialogical model of communication" (p. 21).

Training Educational Psychologists

The role of the educational psychologist (or school psychologist) combines facets of both the therapeutic and learning relationship. The tasks of establishing a therapeutic alliance and effective adult learning conversations are key, both while studying as competencies are being developed and later when qualified and in practice. Given the strong links between intersubjectivity and attunement and the tasks required for adult learning, it is possible to argue that VIG could have a role in enhancing intersubjectivity and attunement in the context of developing professional competencies in the fields such as psychology, psychiatry or education (indeed conceivable in a very wide range of professions). This would at face value seem to be a significant change of context from the theoretical roots of the VIG model, but it is perhaps a more logical extension of the approach from its historical application with parents and children.

The contribution VIG can make to professional competencies in a different context has already been explored by Hayes, Richardson, Hindle, and Grayson, (2011). Here research was undertaken into the impact that VIG could have on the professional skills of teaching assistants working in schools. Quantitative findings from this small-scale study indicated that teaching assistants experienced significant benefits through the approach in terms of the quality of their relationships with young people they worked with in school. Qualitative findings indicated that increased self awareness and reflection were recognized as key benefits of the process. Results also showed that while the task of being videoed was initially found to be anxiety provoking and aversive it was later experienced as a very positive process.

At University College London (UCL), the doctorate in Educational and Child Psychology program

aims to enable trainee educational psychologists to integrate theory and practice effectively to become skilled and accountable professional practitioners. The 3-year doctorate program develops professional competence as defined by the Health and Care Professions Council (HCPC) Standards of Proficiency (SoPs) and British Psychological Society Required Learning Outcomes. The professional training program achieves this through focusing on the three elements of academic knowledge, research ability and professional practice. VIG was introduced as part of the course in 2009 in order to focus on the final skill set. VIG aimed to extend and enhance trainee psychologists' interpersonal effectiveness skills using a shared framework of communication (the principles of attuned interaction).

Although there are many things to learn while training to use VIG, there are two key areas of competency that are required to use VIG effectively: firstly, microanalysis of video footage and secondly, conducting shared reviews, both of which are important to using the method as an intervention. The VIG approach also aims to develop trainees' awareness of their own communication skills and reflectively review how to evolve these to improve effective communications with clients. A core competency for educational psychologists is the ability to consult, communicate and co-operate with others in a supportive manner. Indeed, the need to build the trust and respect of service users (SoP 1b.3.7; HCPC, 2012) and use a range of appropriate forms of verbal and non-verbal communication (SoP, 1b.3.8; HCPC, 2012) are core competencies. VIG offers a means and method by which trainees could critically examine their interaction skills and inform professional development in an illuminating and informed manner.

How VIG Fits into the Training Program

VIG is used at UCL as a tool for reflective practice to enable trainees to evaluate existing communication skills and critically consider alternatives in a supportive fashion. This resonates with the HCPC SoPs to recognize own interpersonal skills (SoP, 1b.4.1; HCPC, 2012) and monitor and review practice (SoP, 2c.1; HCPC, 2012). Moreover, VIG uses video of the individual in live practice situations, which would make learning relevant for trainees in keeping with adult learning models and underpinning the doctoral training course. In this way self-directed learning could occur across domains of development since it is rooted in the individual's own experiences, making it as meaningful as possible (Knowles, 1984). Finally, VIG would form and follow the spiral curriculum at UCL, with learning occurring in a recursive fashion, revisited and reviewed over time as professional skills progress. The use of

VIG was infused across the 3 years of the doctorate to ensure effective learning experiences in the evolution of communication skills. It was designed to develop trainees' interpersonal effectiveness by deepening understanding and skills beyond base line standards of proficiency.

VIG is introduced in the first year of the program (see Appendix) as a method by which to develop trainees through learning about their own skills in effective communication. The principles of attuned interaction serve as a framework by which trainees can become more aware of, and analytical of, their own interpersonal and intrapersonal style. Trainees use video of themselves and micro-analyze this alongside tutors and fellow trainees to explore and critically evaluate their own communications skills. The use of their own video provides a potent and powerful tool for trainees to engage in self-reflection on their interpersonal effectiveness. In this manner video enhanced reflective practice is the main mechanism of learning. The use of trainees' own videos offers an illuminating insight as to their own style and skill in face-to-face communications. The work in the first year then forms the foundation for learning which is built upon in the second year in a 2-day training on VIG in which trainees receive teaching on the approach and experience how to both use and implement it as an intervention. In this way VIG is used as a vehicle to support professional development (see Figure 1). The principles of attuned interaction are revisited and revised for trainees and then extended into the context of live practice situations that trainees bring to the session. In these workshops the trainees bring video footage from professional practice with clients in order to facilitate their development of interpersonal effectiveness skills. The microanalyses of video are used in the context of VIG, and the skills of conducting a shared review using the video are practiced. Such skills are then built upon in the third year.

In the third year, the skills of microanalysis of video and then use of selected clips in the context of shared reviews are practiced in a series of workshops and supervision sessions. At this point the trainees take video of themselves in real live practice situations and then microanalyze each other's footage. This is then used in supervision with a tutor to microanalyze and identify individual clips to use as feedback with a paired trainee colleague in a shared review. These shared reviews place the trainee in the position of VIG Guider and recipient. In this manner, trainees both experience VIG as a client and as a Guider with the supervision and support of the tutor. Such shared reviews are filmed and then microanalyzed by the trainees and tutor to further inform professional practice skills. This offers a meta-evaluation using video in a powerful way to critically examine and evaluate professional skills. The experience ensures that trainees refine their communication skills between VIG supervision sessions by identifying their own goals for development in a self-directed fashion. This culminates in a reflective commentary which trainees submit to outline the development of their professional competencies in relation to VIG across the doctorate program. Edited video forms part of the piece to allow trainees to explicitly evidence the evolution of their communication skills.

Perspectives of the Students

Student evaluations of VIG. Students in the doctorate program provided anonymous evaluations of all their teaching and supervision sessions on the course. The evaluations for VIG taught sessions and VIG supervision sessions over a 3-year period were collated. Students rated the sessions on a 4-point scale: *excellent*, *good*, *satisfactory*, and *unsatisfactory*. 114 separate ratings over three years indicated that VIG was very positively received by the students with 56% of the ratings given as *excellent*, 37% of the ratings given as *good*, and 7% given as *satisfactory*.

Additional comments on teaching and supervision sessions included many comments reflecting the value the students could see in using video in this way. Students often commented on how the teaching and supervision sessions felt, and that there was acknowledgement of the anxiety associated with being on video and the supportive nature of the teaching and supervision sessions. For example, "Very supportive and constructive way of micro analyzing individual video footage. Tutors were extremely encouraging and positive in the feedback provided, and small groups made the task feel less daunting"; and,

> Although I was quite apprehensive about analyzing the videos before the session, the supportive atmosphere made this a really enjoyable experience, and I felt I learned a lot about the ways in which I interact that I was not aware of before the session.

These student comments highlight how the small group structure and strength-based approach used in VIG often worked to allay the fear that being videoed can evoke.

Students commented on the session as an enjoyable experience and one that they value in terms of their learning. For instance, one student explained,

> This session was really enjoyable. The introduction to VIG was very useful and is something that I hope to use in my future EP practice. I really

enjoyed the positive focus of the intervention, which was reflected within the session.

Another student noted,

> A really interesting session. It was great having a range of views from the session leaders. The use of our own video to use the structures discussed throughout the session was really useful in developing a deeper understanding of VIG.

The fact that students found the VIG sessions engaging and interesting may well have had an impact on their use of the skills learned. Indeed, the quote from the first above indicates that they intend to use the skills in their practice post qualification. The themes that are seen in these initial reactions can also be traced in the student's views about the process when they reach the end of the program.

Student reflections after the full VIG process. As part of their professional portfolio submitted at the end of the training program the students are required to include a reflective commentary exploring their thoughts, feelings and learning points relating to the VIG process. Thirty-nine reflective commentaries were used to identify examples of learning points and reflections on the process that are of interest. The quotes are not presented as necessarily being representative of all 39 and the text has not been subjected to formal thematic analysis or content analysis as the intention is not to present a research paper, but a description of the practice and some illustrative comments from student reports.

As they had started to do in their evaluations, students identified the contribution that VIG made to their professional competencies, some noting the particular advantages of using video. Students related the experience to the development of professional skills and competencies that are needed for psychology. For example, one student said,

> I feel that my interpersonal and consultation skills have developed during the professional training. Initially, I had to be consciously aware of active listening skills such as paraphrasing, summarizing and feeding back, but now I feel these skills come more automatically and I can concentrate on the quality of my questioning skills.

Anther student explained,

> [Interpersonal and intrapersonal skills] are skills that I have been working on, and received feedback on, throughout the course, but VIG was useful as it allowed me to watch myself in the video. This provided a more objective, and more insightful,

way to reflect on my skills than either just receiving feedback following an observation, or just reflecting in my head on how a meeting had gone.

The comment by the first student above appears to be describing his or her progression through the conscious competence learning model with the student moving from conscious competence to unconscious competence in certain skills. The usefulness of the video for self-modeling is highlighted by the second student.

As well as developing specific skills, the students commented on the distinctive contribution that the use of video has:

> A unique feature of the approach that I found particularly useful was watching myself 'from a distance' on the video footage and having time for self reflection. I found that these aspects promoted my critical thinking about a range of my interactional behaviors.

In line with the intention for students to relate the learning to key principles in effective interaction, some students identified learning that related to sensitivity, attunement, or intersubjectivity. For example, a student explained,

> I was also aware of the importance of developing secondary intersubjectivity with the client, thereby maintaining attuned interaction and effective communication. I found this difficult initially, as it was a new skill to have to refer to while also receiving and encouraging interactions.

Another student noted,

> Myself and the consultees [*sic*] appeared attuned for a large proportion of the discussions. There was balanced turn-taking between us, I checked that she understood me and we 'had fun' at appropriate points in the discussion. These attuned interactions had a positive impact on the consultations, such as the consultee being "activated" throughout and providing a foundation for the higher levels of communication (e.g., collaborative problem solving).

As this last quote highlights, students readily make the link between the understanding and competences that are developing in terms of interpersonal skills and the overall outcomes and aims of their work: effective problem solving with other people, generally teachers or parents in the case of the educational psychologist. This next example also illustrates how students can see the relevance of the approach to the practice of promoting psychological change in others:

The learning that I have experienced using VIG has developed my interpersonal skills that show a sensitivity for the needs of others. This is because the principles of attuned interaction emphasize receiving the other person and following their initiative. The practice of deepening the discussion as outlined in the section above on future learning has also given me the tools to "appropriately and assertively challenge assumptions or viewpoints in a constructive manner to move matters forward." Being able to do this facilitates others' learning as they are able to challenge their views of the self and reframe their attributions about their abilities and relationships.

A balance of caution and fearfulness of having your professional behavior presented before you, coupled with a sense of the value of this is seen in the following comment, made by the same student:

I felt vulnerable to comments from others on my professional style. This enhanced my understanding of how vulnerable clients may feel when their interactions are analyzed and the importance of a guider being sensitive and supportive in their comments if this is to be constructive.

Other writers have noted apprehension and anxiety related to the use of videos (if common) and the need for a supportive process (Borko et al., 2008). Establishing this is at the heart of the VIG method and, despite the drawbacks associated with the initial fear that might be experienced by students, the realization that it is a positive learning experience inevitably follows. For example, one student explained, "VIG offers a nurturing environment in which to explore areas for development. The positive focus helps people be open to change through advice, support and feedback. I can now understand the value of offering learning conversations based on videos."

Conclusions

The experience of incorporating VIG into the professional doctorate in Educational and Child Psychology has demonstrated that it can make a valuable contribution to the learning of students whose interpersonal and intrapersonal skills are key to their success in their field of work. While anonymous evaluation shows the positive way the experience is received by the students, illustrative comments from the reflective commentaries also highlight that students recognize a potential additive benefit of VIG over and beyond other forms of teaching and learning. There are also areas that anyone implementing VIG should be

alert to in terms of potential drawbacks. As an accredited approach, tutors delivering VIG need to undergo significant training in the approach themselves that lasts a minimum of 18 months. Only then can tutors begin to learn to use the approach on the course in the role of trainer and supervisor. This works well where tutors are also, for at least some of their time, practicing applied psychologists using VIG in their work. A second potential drawback relates to the need for technology. Establishing and maintaining the technology requirements for students to take, edit and view their own video is much easier today than it was a decade ago, but even now there can be software glitches and other issues. Good IT support is essential.

Future Research

VIG and its applications have the potential to be used as valuable learning tools within higher education, particularly during professional training in applied psychology and the helping professions. Further research is needed in order to examine where it is most effective and the key mechanisms of change involved.

Much research remains to be done. For example it would be useful if research was conducted to compare the skills of those using VIG and/or video enhanced reflective practice with more traditional methods of developing interpersonal and intrapersonal skills. In addition, longitudinal studies on the impact of VIG on skills over time would add to the evidence base. Studies evaluating how VIG could be used to improve students identified as requiring support in developing their skills would be useful. Feedback and evaluations from clients that students within professional training have worked with would also add the client perspective to research. However, despite the need for future research VIG has demonstrated that it is a very useful reflective tool for higher education.

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Appendix
Progression of Skills in Video Interaction Guidance Through the Course

Year 1. Introduction to VIG.

Whole group introduction to microanalysis using a selection of videos of adults and children from VIG trainers archive. **Video Context:** Small group initial practice of microanalysis using a video of TEPs own interactions at university.

- Application to self-reflection and interpersonal effectiveness skills development.
- Understand the Principles of Attuned Interaction.
- Begin to be able to microanalyze video footage of self.
- To understand the background theory to VIG and apply this knowledge to other aspects learning and professional development.

Year 2. A 2-day VIG training course.

Take a lead on microanalysis of video of another person's interaction for the first time in a small group context. First introduction to guiding in a shared review and first experience of VIG supervision.

- Advanced and specialist training into application of the method.
- Develop confidence with microanalysis and of analyzing footage of other people.
- Begin own skills progression as a guider in the shared review.
- Experience supervision.

Year 3. Application and development.

Take full responsibility for undertaking microanalysis of two more videos of another TEP interacting in a real placement situation. Also an opportunity to see change in the situation over time. Take part in four further supervision conversations. (Two individual sessions focused on microanalysis and two small groups sessions focused on shared reviews.)

- Developing skills in establishing the therapeutic alliance.
- Individually tailored video interaction guidance and practice.
- Develop increasing fluency with microanalysis.
- Extend experience of guiding in shared reviews.
- Complete a written assignment demonstrating an understanding of theoretical underpinnings and application of VIG within educational psychology. Also to include reflections on own learning experiences using VIG.
- As a "client" experience VIG as an intervention used to support professional development as a TEP.

A Global Dialogue on Peace: Creating an International Learning Community Through Social Media

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Technology and social media, often seen as counter productive to student learning, can provide intriguing new ways to extend and enhance learning across international borders. This article explores one successful learning project, based on the Nobel Peace Prize, that connected students from Norway, South Africa, and the United States through various social media forms, allowing them to learn about, dialogue on, and create projects surrounding the concepts of world peace, sustainable peace, and global citizenship, while themselves practicing that citizenship. The article details the pedagogy behind the learning project, explains the student responses, and describes the way that the high impact practices involved helped to increase student engagement. It also describes the international faculty collaboration that made this international learning project successful.

Recent studies point to several specific learning methods and opportunities that can have a significant impact on student learning and engagement. Among these high impact practices as outlined and assessed by the Association of American Colleges & Universities (AAC&U), are common intellectual experiences, learning communities, collaborative assignments and global learning opportunities (Kuh, 2008). If these practices can significantly enhance student academic performance at the local level, what could occur if the practices are extended and integrated across international borders to engage students from different cultures and to allow them to work together on meaningful topics? With the technology and social media tools now available, can local high impact practices be extended, shared and maximized?

For many years, the benefits of using technology to augment student learning have been studied. Heinich, Molenda, Russell, and Smaldino (2001) highlighted the use of various types of technology as aids to improving student learning. As technology has developed and become more pervasive and amenable to classroom use, computer-based technology has "dramatically increased to include emerging technology for visual presentation, simulation, accessing course materials and World Wide Web resources, and interactivity" (Debvec, Shih, & Kashyap, 2006, p. 293). In most recent years, web technology has become ubiquitous at most institutions and in many classrooms (Arbaugh, 2005; Boulos, Maramba, & Wheeler, 2006). For those educators interested in improving student learning in the physical classroom by connecting students to a global community of learners, the use of web-based technology can create more venues for international study and student engagement, and it can, through the use of discussion boards, blogs, and social media venues, foster a more collegial atmosphere for learning that includes students in classrooms across the globe (Ossiansson, 2010).

A recent pedagogical pilot project involving three colleges—the American College of Norway (ACN) in Moss, Norway; the University of North Dakota (UND) in North Dakota, USA; and Nelson Mandela Metropolitan University (NMMU) in Port Elizabeth, South Africa—specifically details the way in which students at international sites can be brought together via technology and social media to engage in high impact learning practices through a global dialogue on important issues like world peace, sustainable peace and global citizenship. The techniques used in this experiment can easily be replicated in or tailored to other classrooms and learning activities.

This pilot project was constructed around the annual Nobel Peace Prize Forum (NPPF) at Augsburg College in St. Paul, MN, and therefore centered on issues of world peace and sustainable peace, topics that naturally lend themselves to an international discussion. It involved the aforementioned institutions, where a group of faculty from each worked to create a set of readings, assignments, and discussions for all three colleges that could be facilitated in individual classes but that would provide frequent opportunities for interaction via various online forums. Faculty and staff at these institutions met in person and virtually to construct a learning project that would allow groups of their students to read extensively about world peace, global citizenship and sustainable peace, to complete assignments surrounding these issues, to formulate informed responses to specific questions, and to dialogue through Facebook and blogs, with students at the other participating institutions about these topics. Ultimately, students participated in person and virtually in the annual NPPF where they could hear international celebrities, including Nobel Peace Prize Laureates, address these same issues.

This extensive set of assignments created to facilitate an international collaborative learning opportunity grows out of a long time collaboration between the ACN and the UND and is based, in part, on

the success of other integrative classroom experiences (Carmichael & Carmichael, 2012; Carmichael, Finney, & Magnus, 2005; Hilliard, 2012; Slater, 2010). The collaborative assignments were built on the recognition that student engagement is critical to academic success (Astin, 1993; Kuh, 2008) and embraced the belief that "technology can be harnessed to enhance the widely desired goals of increased student engagement" (Bowen, 2012, p. x).

The ACN is a unique learning community that offers up to three semesters of university courses to Norwegian, American and other international students. The Norwegian and other non-U.S. students transfer to universities located within the United States to pursue their desired bachelor's degrees upon completion of the ACN program. American students typically spend one semester at ACN as a study abroad experience. Faculty from the UND develop and teach courses for ACN, and these two schools have partnered in an international exchange of faculty and students for over 20 years. UND, a large comprehensive research university with over 200 majors and over 15,000 students is the official school of record for the ACN. ACN helps to facilitate both student and faculty exchange between Norway and the United States, and over a thousand students have participated in the program. ACN seeks also to form various educational partnerships with other international colleges, including, most recently, NMMU in South Africa, a public university with over 23,000 students. The ACN has always pursued a strong philosophy of peace studies and human rights education, and its work on these particular assignments is one in a series of educational experiments aimed at bringing young people into a global awareness of the need for understanding and activism. Thus this project—bringing students together virtually across three continents—was a natural outgrowth of the institution's ongoing educational mission.

The Nobel Peace Prize Learning Project: Pedagogy and Practice

American College of Norway

In addition to its educational partnerships with U.S. and international universities, since 2011 the ACN had been a remote partner in the NPPF, which is housed and organized by Augsburg College, MN. The NPPF is a "unique civic learning experience" (NPPF, 2014, para. 2) that celebrates Nobel Peace Prize Laureates and the work done by individuals and organizations in peacemaking efforts (see more about NPPF at www.nobelpeaceprizeforum.org/about). In an attempt to bring the forum to the global level, Executive Director of NPPF Maureen Reed came to Norway in December of 2010. In a meeting with the ACN it was

decided that the two organizations would collaborate. Faculty at ACN would integrate the theme of the annual forum into the classroom, ACN staff and faculty would create additional learning forums for students to approach issues surrounding globalization and peace, and students would watch and participate in the NPPF via live streaming.

The staff at ACN knew that participation in this internationally viewed forum that features Nobel Peace Prize Laureates and offers opportunities to hear them live and interact with other peace activists around the world was incredibly important and should be fully integrated into the curriculum of some of the ACN courses and shared with other students at international universities. Thus a method for better engaging students in the conference was sought, and the concept of piloting a cross-border Nobel Peace Prize Project was created to put into place during the 2012-2013 academic year.

In the initial planning stage for Peace Prize Project, ACN staff met and decided to take an ambitious route to encourage higher levels of student involvement and engagement. Five main goals were developed:

- to reach out to students outside of Norway and the United States and include them in international dialogue;
- to engage these students actively over an entire semester by integrating project readings and activities to ongoing classwork at ACN and participating institutions;
- to create culminating projects that could be shared internationally via various platforms;
- to allow students freedom to plan activities and projects surrounding the NPPF that were meaningful to them; and
- to prepare and present a break-out session at the NPPF.

Creating the International Partnership

ACN decided to involve all 70 of their students, which included both Norwegian students and U.S. students studying abroad at ACN. Then ACN staff invited the faculty and students of the Integrated Studies Program (a first year learning community) at UND to participate. Sixty first year students in this program participated. Finally, ACN invited forty undergraduate students at NMMU to participate. These students came from South Africa, Zimbabwe, and Zambia. It was felt that reaching these groups of young students early in their postsecondary career and allowing them access to interact with each other, even through remote, electronic forums, would lead to cultivating in them a deep interest in issues of world peace and a sense of global dialogue that would expand their viewpoints and encourage the

kind of developmental growth that occurs as part of an international study experience.

The project's main theme was to be based around the idea of globalization, disarmament (nonviolence) and dialogue. These three ideas were inspired by the work of the first female recipient of the Nobel Peace Prize, Bertha von Suttner. Norwegian author Anne Synnøve Simensen's (2012) recently published work, *Kvinnen Bak Fredsprisen: Historien om Bertha von Suttner og Alfred Nobel/The Woman Behind the Peace Prize: The History of Bertha von Suttner and Alfred Nobel*, detailed peace activist Bertha von Suttner's influence on Alfred Nobel and her influence in his establishment of the Nobel Peace Prize. Simensen agreed to work with the ACN and to be part of this international dialogue with the other partner university students.

As it was important that the Peace Prize Project be integrated into all of the classes, Spring 2013 faculty at ACN were made aware of the project and the opportunity to work with Anne Synnøve Simensen. Faculty were asked to be a part of the planning process and to build portions of their curriculum around the themes, issues and ideas generated through the project. Instructors teaching courses in the Humanities, English, and Political Science agreed to participate. It was understood that some students, being more naturally inclined, would want to participate more fully, but it was desired that the entire student body be asked to contemplate the topic and become more aware of the Nobel Peace Prize and the NPPF. This was achieved by the integration of the theme into each class to varying degrees. Thus it would be that all students in all ACN classes would become familiar with, and think critically about, these issues. For students interested in engaging more fully with the issues and event, the ACN Nobel Peace Committee would be formed. This committee would be made up and directed entirely by students and would help shape the direction of the Nobel Peace Prize Project overall. Both the in-class assignments and extra-curricular student committee would promote student engagement in the issues surrounding the international dialogue.

Common Classroom Materials and Social Media Assignments

At the classroom level, ACN staff and UND faculty worked together to develop a structure for student discussion modeled on "Socrates Café" experiences that would be local and global, shared through social media. The Socrates Café, introduced and utilized by Christopher Phillips (2002), brings small discussion groups together to discuss discreet, specific and stimulating topics like, "What is justice?" It was decided that groups of students at each institution would engage in Peace Cafés about a set of the same specific questions, would share the culminating responses via social media (Facebook groups and blogs) and would use those same media to comment on the responses of the other students. The questions would grow out of and would utilize literature on the ideas and philosophies surrounding "peace," and that all students would read the same sets of literature. ACN staff and Anne Synnøve Simensen would create the packet of readings and would provide a bare structure for activities, but it was decided that students themselves should choose and develop the forums for on-ground and online discussions as well as any other projects they felt were important, making the project more immediate and interesting to the students' own learning. Faculty at all three institutions agreed to this structure and approach.

The literature packet created included excerpts from Bertha von Suttner's (2009) famous book *Lay Down Your Arms,* speeches by Victor Hugo, excerpts from Tolstoy's (2010) *The Law of Love and The Law of Violence,* letters exchanged between Tolstoy and Gandhi, and speeches from Nobel Peace Prize Laureates such as Martin Luther King, Jr., F. W. de Klerk, Christian Lange and Mother Teresa. As Simensen's (2012) book was only available in Norwegian, an ACN film student was engaged to bring Bertha von Suttner (2009) to the screen. A short documentary was created to effectively tell the story of von Suttner and was posted to a YouTube site. The documentary and the literature packet were shared with the participating institutions.

Armed with the same basic knowledge included in the literature packet and documentary, students at the ACN, the UND, and NMMU were then asked to conduct a series of Peace Cafés. In these philosophical gatherings, small groups of students were asked to use the Socratic method to explore the questions "What is peace?", "Who is a global citizen?", and "How can sustainable peace be achieved?" Simultaneously, these questions were being pondered on three different continents.

The groups in North Dakota and in South Africa were asked to summarize their conversations in writing and email them to the ACN. The conversations were published on a blog developed by ACN students, and excerpts were posted to the ACN Promoting Peace Facebook page. Students at all three institutions were able to analyze and debate the responses of their international peers, and they considered why groups would have similar or different ideas about the questions. Allowing three seemingly different groups of students access to the same information and then asking them to discuss three open-ended questions using the same method of discussion was an enlightening opportunity for all students involved and an effective

way of globalizing the project. Suddenly, a more localized, discreet project became a group effort on a global scale, providing students with experience in working with culturally diverse groups of their peers and asking them to collaborate across borders and social media platforms. These responses continued to be shared by the students at each institution via the blogs and the Facebook site. In turn, in each classroom, the responses posted online became the topic of conversation among the students and with the faculty.

The Global Learning Community

Students from the interdisciplinary Integrated Studies Program at UND participated in the project over a series of eight weeks. They began with student centered research projects that asked the students to find out information on the Nobel Peace Prize, to whom the Prize has been granted in the past, and on the criteria for the award. Students worked in small groups, using online resources to find answers to the questions. They shared their findings with each other, developed sets of new questions, such as "Who deserves a Peace Prize?" and "How many women have received a Peace Prize?" which they also sought to answer through online resources. To end the session, they watched the video on Bertha von Suttner that ACN made available through YouTube.

After a larger group discussion of findings, students carried on their work outside of class by reading electronic copies of all of the ACN literature packet readings, posted on their online classroom site (Blackboard). They prepared responses to questions based on their readings, which they brought back to class. In class, they worked in revolving, small Peace Cafe´ discussions, to use their new knowledge and their own experiences to answer the three key questions: "What is Peace?", "Who is a global citizen?", and "How can sustainable Peace be achieved?" Their answers were reported, by them, back onto the classroom online discussion board and the course instructors emailed the responses to ACN, where students there posted those comments on the blog and Facebook page along with answers from the ACN students.

UND students continued their participation by reading the blog and Facebook page and making comments. In addition, they watched live-streamed and recorded versions of the NPPF on Bertha von Suttner, where Anne Synnøve Simensen and the ACN students presented their work. After the forum, the UND students met for one final Peace Cafe´ at an on-campus coffee shop where they discussed all of the material they had learned, information from the NPPF and all the answers on the three questions posed from the student groups in Norway and South Africa. Then they made their final contributions to the online global dialogue.

The faculty and students from NMMU held three preliminary sessions of preparation using the readings provided by ACN. They also watched the YouTube video on von Suttner and then watched two live-streamed sessions from the NPPF. Following those sessions, students participated in hour long Peace Cafés on the same three questions that the other institutions used. Their conversations were posted to the ACN Facebook page and to the blog. A final reflective paper was required of all students as part of their course requirements.

As the literature suggests, giving the core of the responsibility to the students and allowing them to develop their own projects and weigh in on the material gave impressive results (Astin, 1993; Glasgow, 1997; Kuh, 2008; Light, 2001; McCombs & Whistler, 1997; Newell, 2001). The weekly meetings of the ACN Peace Committee allowed the ACN coordinator to give feedback on the progress being made, encouragement when needed and guidance when necessary. Attendance at the weekly meetings was very high, despite the voluntary nature of the group. Students were often excited to show what they had been working on and interested in what the other groups were doing. The original idea was that the Peace Committee would conclude its work once the NPPF took place in March. A unanimous vote by the committee members amended the end date to the last day of the semester, an addition of five weeks, because the group wanted time to continue developing larger projects inspired by the involvement of the students from the participating universities as well as by the speeches heard during the NPPF. This kind of student investment in learning can be rare, but it is essential to motivating life long learning attitudes and to engaging students in work that will be meaningful to them and to a world that needs their energy, passion and ideas.

Student Engagement Opportunities

For students wishing to be further involved, the goal of the project was to transfer much of the responsibility to the students themselves to increase involvement since it is well documented that learning that emerges from, and is developed through, the involvement of students is more meaningful and results in better learning outcomes (Astin, 1993; Lardner & Malnarich, 2009, McCombs & Whistler, 1997; Newell, 2001) and higher levels of engagement (Boix Mansilla & Duraising, 2007; Kuh, 2008). In early December 2012, students at ACN were invited to a meeting at the College to discuss the NPPF and ACN's role in it. Eighteen students (out of a student body of 66) voluntarily came to that introductory meeting, which began with a brief explanation of what the NPPF was

and how the ACN had participated the year before. Then each student was asked to provide a suggestion about what they would like to do and an argument for how it related to the ideas of globalization, disarmament (nonviolence), and dialogue.

This initial meeting lead to the creation of the ACN's Peace Committee, with students from both Norway and the US comprising its members. Sixteen participants joined the committee, and each individual was assigned one or multiple areas of responsibility. Students met weekly as a group from January to May, and active group work was done on the students' free time. Students produced videos and wrote and produced songs, created blogs and a Facebook page, created art pieces and choreographed and performed dances, all relating to peace issues.

The final goal of the 2013 project was to send a delegation of students to Minneapolis, MN to not only attend the NPPF, but also to present a break-out session at the forum. Together with Norwegian author Anne Synnøve Simenson, two ACN students were invited by the forum to present on Nobel Peace Prize Laureate Bertha von Suttner and the work that ACN had done based around the ideals of von Suttner in cooperation with the UND and the NMMU. This session was the only break-out session at the 3-day forum to be live-streamed so that students at the partner institutions could participate in real time. The session, like most other events at the NPPF, was also recorded and was viewed by people from around the world.

Student Responses

The dialogue that ranged across three continents yielded encouraging results that students expressed via the blogs and Facebook postings. As previously stated, students were asked specifically to think critically about the following questions:

- What is peace?
- Who is a global citizen?
- How can sustainable peace be achieved?

In a pre-writing experience, before the Project began, students were asked to respond to these questions, and overall responses were general, vague, and lacked any critical thought. Following are some representative responses: "Peace is good for everyone and we should work to have peace everywhere"; "We live in a global world, so we are all citizens of it"; "Peace is when there is no one fighting. It can't be attained because there will always be war"; and, "Peace is the opposite of war, and we need opposites."

However, after engaging in the Project's campus-based discussions, the blogs, and the Facebook discussions, student online responses became ultimately startling and sophisticated. Several students offered sample responses:

- "Peace is a combination of many things we practice everyday. These things are Love, Happiness, Justice, Equality, Compassion, and Cooperation. Also, Peace isn't only the absence of war, but the absence of all things that lead to war. These things range from: poverty, racism, and intolerance."
- "Peace is the mutual understanding that others will have different ideals and the ability to accept and tolerate them—the ability to take things for what they're worth instead of causing conflict. Peace can come from putting others above yourself and valuing others' opinions. Peace is conflict without anger as well. A peaceful person isn't a push over, just someone who isn't going to get angry or violent at things he or she doesn't agree with."
- "'Violence, lack of concern, and the lack of human welfare. This must never be allowed to start. And the place to stop it is at the level of the individual' (Mumtaz Soysal). An individual's efforts towards the betterment of justice, equality, and peace for all are the traits of a global citizen."
- "To ensure sustainable peace, it is important for all citizens to have a quality standard of living and equal human rights. We must be willing to have sacrifices for the good of others; [*sic*] give back to the less fortunate. If people had more power, more peace would be translated through equal representation of groups."

These responses, and many others like them, grew out of hours of intense conversation among student groups within each institution, were based on research and reading the students had completed, and became fodder for international response and consideration once they were posted on the blog and Facebook. It is clear that students developed much more critical, informed ideas about these important topics as they pursued thinking about them and discussing them with their international peers. The perspectives articulated in the final online responses also indicate a level of global perspective informed by international discussion.

In addition to the international dialogue, other creative projects emerged, particularly at ACN, the hub of the entire project. These projects were proposed and carried out by students and made available to the students at the other two partner institutions. The Peace Committee from ACN, comprised of both Norwegian and U.S. students, became incredibly invested in the project, producing the following:

- ACN Promoting Peace website/blog (http://acnpromotingpeace.wordpress.com/): One student (a communications major) designed and created the site; three students (a political science major, a business major and a journalism major) blogged about peace-related issues.
- ACN Promoting Peace Facebook page (https://www.facebook.com/ACNPromotingPeace?fref=ts): Four students were responsible for engaging participating students in conversation using this medium of communication.
- Photography: Two students (an astronomy major and an anthropology major) recorded the work of the group in pictures.
- Live-streaming of the NPPF: Five students were in charge of arranging a three-day event at ACN to encourage as many students as possible to attend the live-streaming of NPPF.
- Art work: Four art students expressed their ideas of peace through artwork.
- Music (available on ACN Promoting Peace Facebook page): Two students wrote and recorded songs, one of whom wrote, filmed, and edited an accompanying music video.
- Dance: One student, active in dance, made a documentary about how some young Norwegians with minority backgrounds use healthy activities such as dance to lead healthy and successful lives rather than turning to crime.

Two students were selected to attend the NPPF in Minneapolis, MN, and accompanied ACN staff and Anne Synnøve Simensen. These students had the opportunity to meet and talk with Novel Peace Prize Laureates Dr. Mohammad Yunis and Tawakkol Karman. They were also able to share, with a global audience, many of their ideas developed throughout this project, while their colleagues from ACN, UND, and NMMU watched and participated via live streaming.

The result of the many hours of voluntary work was a very active and engaging Facebook page with interactions from students in the US, Norway, and South Africa, a blog that had thousands of views from over 28 countries, hundreds of photos documenting the work of the group, four pieces of artwork (one presented to the Executive Director of the NPPF and one presented to Anne Synnøve Simensen), two original songs written and recorded by ACN students, a music video, a dance documentary, and a successful Weekend of Peace arranged by a group of students for the viewing of the NPPF.

Though students at UND and at Nelson Mandela University were not as active as the core ACN student Peace Committee, they were able to connect more fully with the important issues of sustainable peace and global citizenship because they could come to these topics through their peers in other countries. Understanding and debating issues of this nature with people their own age, in media forms that they embrace and use well, led them to engage more fully in the debate and to create thoughtful responses to important questions.

Analysis and Conclusion

It has, of course, been known for a very long time that international experiences like study abroad can have incredible impacts on student learning and engagement (Bollag & Field, 2006; Carmichael & Carmichael, 2012; Coleman, 2001; Hilliard, 2012; Klein, 2002). Study abroad is perceived to increase sensitivity to global issues, increase learning engagement, and stimulate life long learning (Stroud, 2010; Tarrant, 2010). In addition, as stated previously, high impact practices that include group work and learning communities, increases levels of student engagement and hence of student success (Kuh, 2008).

However, not all students can study abroad, and, until fairly recently, the ability to interact immediately and intimately across geographical borders was incredibly slow and, for the purposes of daily education, virtually impossible. With the advent of technology and social media, however, the possibilities for international dialogue, for the formulation of learning communities whose borders extend across continents, and for immediate global debate, are endless. It is the case, in fact, that this project would not have been possible without technology like Blackboard, live-streaming, and digital recording devices or without social media forms like YouTube, blogs, and Facebook. As the ability for international collaborations like this continue, faculty and students will have access to more methods for participating in "collaborative activities in multicultural settings which could add to participants' knowledge and skills" (Hilliard, 2012, p. 1).

Technology has "radically altered the availability of knowledge" (Bowen, 2012, p. 2) but, by taking control of our ability to foster deep learning skills like critical thinking, writing and communication, faculty can harness technology and social media to facilitate students' abilities to engage with their own learning and with issues of national and international importance (Fink, 2003). The use of social media particularly in this project offered students an immediate and personal way to interact virtually that, as Grover and Stewart (2010) identified, could not have been imagined a few years ago. Taking advantage of these new technologies, with which today's students and faculty in most countries around the world are comfortable (Moran, Seaman, & Tinti-

Kane, 2011), can allow any college class to be extended beyond the borders of the institution and even its own country. Inviting international discussions has never been easier, and the results of this experiment indicate that the value of these interactions is undeniable and invaluable.

The ACN intends to revise and extend the NPPF activities and assignments, starting the student Peace Committee early in the fall, extending further collaborative opportunities to the UND and to NMMU, and seeking more international colleges to participate. The UND plans to continue in this vital collaboration and will create a specific class on Peace and Human Rights that will have, at its core, participation in the NPPF and the collaboration with ACN. The learning that has taken place through these assignments, the connections made across borders and the high levels of student engagement have been inspiring, and it is clear that this model of learning needs to be continued, extended and reproduced around other issues.

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The "Outsider/Insider" Assignment: A Pedagogical Innovation for Teaching Cross-Cultural Understanding

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In this paper, I describe an innovative assignment for teaching undergraduate students cross-cultural understanding. The Outsider/Insider assignment simultaneously teaches facts about cultural difference and skills for managing cross-cultural encounters. Briefly, the assignment is to write two short papers, one in which the student describes a situation in which he or she was the outsider, and the other a situation in which he or she observed a newcomer to a group where that person was an insider. The paper begins by reviewing previous research on cross-cultural interaction and its relevance for pedagogy, and describing the course, its goals, and the "Outsider/Insider" assignment. The effectiveness of the assignment is demonstrated through an analysis of excerpts from student papers. This analysis shows how the assignment can accomplish learning on a range of dimensions. The main themes that will be addressed are the following: (a) being seen as the outsider; (b) challenges related to outsider status; (c), the relevance of social class, poverty, and wealth on insider/outsider status; (d) strategies for coping in cross-cultural encounters; and (e) benefits to the student of being willing to cross boundaries. The paper concludes with a discussion of how the assignment facilitates student learning and its relevance for a range of undergraduate courses.

According to George Herbert Mead (1934), the ability to "take the role of the other" is a fundamental part of being human and of the communication process between humans. This social process may be more challenging when interacting with someone from a different culture or when acting in a culture that is not one's "home" culture (Al-Makhamreh & Lewando-Hundt, 2008; Brown, 2005; Chawla-Duggan, 2007; Maeda, 2011; Yakushko, Badiee, Mallory, & Wang, 2011). The problem for the instructor of undergraduate courses in diversity, globalization and cross-cultural understanding is therefore how to convey information about culture and cultural difference while at the same time helping students develop the insights and skills they need to successfully engage in intercultural interactions. How can we help students learn to take the role of the other and to see beyond cultural difference into the fundamental human circumstances and relationships that underlie these differences? In this paper, I describe an innovative assignment for teaching cross-cultural understanding, which simultaneously teaches facts about cultural difference and skills for managing cross-cultural encounters. Briefly, the assignment is to write two short papers, one in which the student describes a situation in which he or she was the outsider, and the other a situation in which he or she observed a newcomer to a group in which the student was an insider. I will first briefly review previous research on cross-cultural issues in pedagogy and will then describe the "Outsider/Insider" assignment and analyze its impact through a discussion of examples excerpted from student papers. This analysis will illustrate how the assignment can accomplish learning on a range of dimensions. I will conclude with a discussion of the benefits of this assignment for students and its relevance for a range of undergraduate courses.

Issues in Teaching Cross-Cultural Understanding

The need for cross-cultural understanding is uncontested in today's increasingly globalized world (Martin, 2010; Sohoni & Petrovic, 2010). A wide range of current research into social problems and dilemmas that involve cultural difference serves to illustrate the types of social problems that can be addressed with better understanding of culture and cultural difference (e.g., Christiansen, 2009; Gamson, 2010; Magnusdottir, 2005; Wessells, 2009; Wong, 2011). Crose (2011) provided useful strategies for facilitating learning for international college students, including ideas that will help students increase their knowledge of culture and cultural difference by engaging with each other in the context of class activities. A number of scholars have described specific pedagogical techniques for increasing cross-cultural awareness and sensitivity, including the use of photography (e.g., Brown, 2005), student-conducted research about student experiences and culture (e.g., Deakins, 2009), sociological autobiographies (e.g., Kebede, 2009), oral presentations about cultural differences in communication dynamics (e.g., Miller, 2004), interviews (e.g., de Anda, 2008), and exercises based on Miner's (1956) Body Rituals of the Nacirema (e.g., Schopmeyer & Fisher, 1993).

The outsider/insider frame has been used to explain fundamental properties of social structure. Regardless of culture, we are all continually interacting with others who either share or differ from us on a wide range of social categories such as age, gender, or occupation (Merton, 1972). The outsider/insider frame is an effective way of conceptualizing cultural difference and studying a wide range of cultures and substantive areas (e.g., Bagnoli, 2007; Brown, 2005; Chawla-Duggan, 2007; Moran, 2007; Richardson & LeGrand, 2002;

Rudwick, 2008). For example, in Al-Makhamreh and Lewando-Hundt's (2008) study of social workers in a Jordanian hospital, they explained how a researcher's insider status (e.g., having the same gender or nationality as the research subjects) can facilitate ethnographic research.

Previous researchers have reported a variety of uses of the outsider/insider frame in educational contexts. Schopmeyer and Fisher (1993) used the concepts of insider bias and outsider bias to convey to undergraduate students in sociology courses how ethnocentrism affects their perceptions of those from other cultures. Robles (2009) used the insider/outsider frame to describe the experiences of undergraduate students doing fieldwork abroad. de Anda (2008) used the insider/outsider frame in a series of assignments she uses in her undergraduate course in social work for multicultural populations. Brandt (2007) used an insider/outsider fame and the concept of "border crossing" to analyze how a Native American undergraduate student experienced the science teaching at her university.

Some research done in secondary school contexts is also relevant for understanding how the outsider/insider frame can be useful in educational contexts. Allard (2006) analyzed how an instructor used his outsider status as a resource to connect with a diverse student body. Rychly and Graves (2012) recommend that teachers "be reflective about their attitudes and beliefs about other cultures and their own cultural frames of reference" and "learn to step outside of their own thinking in order to examine it and also to acknowledge others' thinking" (pp. 48-49). Cushman (2009) used an active learning methodology to explore minority students' insider knowledge and make outsiders aware of their lack of knowledge relative to these students. Her students created their own version of an SAT test based on minority students' insider knowledge. Cushman's (2009) survey of non-minority students who took the test showed how it expanded their knowledge of what is was like to be an outsider (i.e., a minority) in a majority culture.

The Outsider/Insider assignment, which I describe below, expands on the work done by others by requiring students to put themselves in the position of both outsider and insider. This practice in taking the role of the other from both positions helps students learn how to see the impact of cultural difference on their own experience and that of others.

Brief Description of the Course and the Outsider/Insider Assignment

I developed the Outsider/Insider assignment for a Global Studies Department course in Cross-Cultural Understanding. The purpose of this course is to teach students from a range of backgrounds about culture and cross-cultural communication both globally and within the United States. The goals of the course include not only academic learning but also the ability to apply the knowledge learned to students' interactions with others.

After the concepts of culture and cultural difference have been introduced, the students read and discuss Polly's (2007) book about the experience of being an American in a fairly remote part of China during the 1990s while he was studying traditional Chinese martial arts, as well as Fadiman's (1997) book on the problem Hmong immigrants living in California faced as their language, cultural and spiritual practices clashed with the expectations of health care providers and social workers. Polly (2007) discussed the challenges he faced being an outsider in a very different cultural context than the one in which he had grown up. The students also watch two films relevant to these topics, *Beijing Bicycle* (Wang, Chiao, Han, & Hsu, 2001) and *Spirit Horn* (Siegel & McSilver, 2001). Students write essays on the films and write quotes and questions on the books read to display their understanding of these course materials and the issues being addressed. These materials are also discussed extensively in class. The Outsider/Insider assignment is designed to help students integrate the knowledge from this first unit of the course and to accomplish one of the main goals of the course, developing the ability to apply knowledge learned in the course to their interactions with others. The students are then given the following instructions for completing the assignment:

- On Being the Outsider: Write two pages about a situation or a time in your life when you were the outsider. If you had the experience of visiting or living in another country, that would be an ideal thing to write about. However, your essay could be about being the new kid in a school where everyone else already knew each other, getting to know someone of a different ethnic group if you were used to a life where your friends and family were relatively homogenous, or the experience of joining a new team or club. What was it like being the outsider? What did the others know that you did not know? How did they react to you? Were you able to gain entry to the group and become a member? How did your perspective change after you became an "insider"?
- On Being the Insider: Write two pages about a situation in your life when you were one of the insiders and one or more "outsiders" were joining the group. It could be the experience of having a visitor from another country, having an immigrant move to your neighborhood or your

work place or school, or simply a new kid of any background moving to your school or joining a team or club you belonged to. How did it feel having the newcomer join the situation? How did you and others treat them? How did they react? Were you able to get to know the person, or did they remain in an outsider status? What issues, problems, or challenges came up through the process of integrating this new person into the situation? What was hardest about it? What was best about it?

Methodology and Results

Participants

Over a third of the 30 students in the class of study were majority group Americans, and the remainder of the students were equally split between foreign-born students and US-born ethnic minorities. Most of the students had already either lived or visited abroad or were planning to do so in the context of a university-sponsored study abroad trip or semester. The students' firsthand knowledge about different cultures and their cross-cultural experiences enriched their work in the class and their work on the Outsider/Insider assignment.

Research Design

After grading the Outsider/Insider papers, I selected portions of each student's paper (ranging from a few sentences to a couple paragraphs from each paper) and anonymously shared them with the class so that the students could learn from each other's experiences. This sharing of the results enabled students to learn specific facts about different cultures at the same time they were learning how their own experiences were similar to, and different from, that of others. They also benefitted from hearing the coping strategies and techniques their classmates used to meet the challenges of a wide range of cross-cultural encounters.

I used a grounded theory approach (Charmaz, 2003, 2004; Glaser & Strauss, 1967; Morse, 1994) to analyze the issues and themes in the students' papers and identify the key themes students addressed which were relevant for the goals of the course and the goals of understanding cross-cultural experiences from the insider and outsider perspectives. This involved a process of coding and sorting into categories the different issues the students raised. Some categories that had only a few numbers of student examples were deleted since the purpose of the analysis was to discover the main issues and themes identified by the students.

Results

The themes that emerged from the students' work were the following:

- On being seen as the outsider.
- Challenges related to the outsider status.
- Social class, poverty, and wealth.
- Coping strategies.
- The benefits of crossing boundaries.

I will next briefly describe how I integrated this pedagogical innovation with the other course activities to achieve the goals of the course.

Pedagogical Impact of the Outsider/ Insider Assignment

In this section, I describe the pedagogical implications of the Insider/Outsider assignment. This assignment was an integral part of the pedagogy of the course. It also served as an assessment of how well students achieved one of the main goals of the course: understanding how knowledge learned in the course could be applied to interactions with others.

Challenges of the Assignment

The main challenge students had with this assignment was with the process of taking the role of the other. A number of students at first could not see the difference between the outsider and insider perspectives. I dealt with these questions on an individual basis and in class, and I was able to get all students to see the difference between one's own experience as an outsider and understanding another person's experience as an outsider to a group where the student was an insider. The evidence that this fundamental concept of how to take the role of the other was learned was that all of the students' papers displayed an ability to distinguish between the two positions.

Benefits of the Assignment

The main benefits of this assignment were that students were required to demonstrate their ability to take the role of the other and to switch between the outsider and insider perspectives as they reflected on their life experiences with cross-cultural encounters. The assignment also functioned as an assessment of the effectiveness of their prior work in the course in terms of how well the first unit prepared them to apply knowledge gained to understanding their life experiences.

Sharing the Results of the Assignment with the Class

The instructor shared key excerpts from each student's paper with the class in a unique way. I pulled the best paragraphs from each essay and arranged them by theme. The students then came up one-by-one and read an excerpt aloud to the class. I had the collective reading videotaped in order to focus the students' attention on reading carefully and listening carefully to each other's work. Because the paragraphs were arranged by theme and the students came up to read in the order in which they were seated, students were almost always reading a paragraph written by another student. They thus had the experience of reading a first-person account of an insider/outsider experience from the point of view of another student (who might well be of a different race, ethnicity, gender, and/or age). This further decentered their individual perspectives and required them to take the role of the other as they did the reading. Through this collective reading experience, all students had an intense exposure to the work done by others so that they could experience the commonalities and differences in their individual perspectives, experiences, and insights. The experience of this dramatic reading then became a shared resource for the class. Throughout the rest of the semester, both the instructor and students referred to paragraphs from this reading while we discussed the remaining topics of the course. For example, one of the subsequent topics was the effect of social class on culture and ethnicity, and some of the students' essays from the outsider/insider assignment were directly relevant for this topic and were referred to by students in class as we considered those issues.

**Lessons Learned from Students' Outsider/
Insider Papers**

In this section, I illustrate the lessons learned from the Outsider/Insider paper assignment by presenting excerpts from students' work that illustrate the range of issues examined. These excerpts show that students were able to articulate what it felt to be an outsider, the challenges in being an outsider, how they handled the challenges, and how they experienced being an insider responding to the needs of an outsider. Not all students wrote about international travel or living abroad. In the course, we defined culture and cultural difference broadly to include such issues as difference in social class, disability status, or social role, in addition to ethnicity and nationality.

On Being Seen as the "Outsider"

Being an ethnic minority is one of the primary ways that people experience being an "other" in a society. Students learned that, while cultural differences can sometimes be hidden, differences in race or ethnicity sometimes make it impossible to blend in. A Korean-American student wrote: "There have been times when I walked into a restaurant in West Virginia and literally have had the whole restaurant stare at me the whole time while I ate." A student from the Caribbean wrote: "Being the minority at a primarily white school has been a norm for me. . . . I was a student of color and that has always made me the outsider."

However, being treated as an outsider did not only happen to those who were perceived as racially different. A Greek-American student talked about visiting her parent's hometown in Greece with her family. She found that although she was also Greek, she nevertheless stuck out like a sore thumb due to her dress and behavior.

The experience of being temporarily disabled made another student aware of what it was like to be easily recognizable as an outsider. This student explained that, through the lesson, he learned about taking the perspective of the other and articulated how this insight changed the way he treated others:

> The collision broke both bones in my shin, in such a way that a simple cast would not bring about the right results. My orthopedic drilled four ten inch titanium screws through my leg and into the bones. After the surgery let us just say, I was easily noticed. I was disgusted how everywhere I went people would stare at me like I was in the circus. That bothered me because they had never met me before or knew what I had gone through. From that point on, I made sure never to stare at a person with a disability because I know what it feels like and I would never want to put someone in that situation.

When examples such as these are shared with the class, students who are not minorities (whether in terms of race, disability, or some other social status) are exposed to their classmates' perceptions of being treated and perceived as the other, thus gaining practice in taking the role of the other.

Challenges Related to Outsider Status

Students who had traveled to a different country often found the transition to a new society difficult. These challenges resulted in unexpected emotional stresses. A foreign exchange student from Australia wrote:

> I had some misconceptions about coming abroad to study. I thought that it would be really easy for me

to fit in. I had no idea going into it how I was going to feel about initially having no friends and family around to talk to, hang out with and lean on. I felt no familiarity with anything or anyone whatsoever. Having to build new relationships from scratch is a difficult thing.

Even those students who had travelled a lot in the past and knew the language of the host country found living in another country challenging in many ways. Students became aware of the impact of different degrees of fluency in a language on their ability to engage with others. A Vietnamese-American student who was visiting relatives in Vietnam wrote:

Although Vietnamese was my first language, I found forming sentences and phrases took too long, while my cousins were spitting out sentences without rethinking. Because of my slow processing of the language, I felt more like an outsider than I already had. As an outsider, I was silent and did not speak unless spoken to.

An international student attending college in the United States wrote about the challenges that existed in spite of his fluency with the language:

The most prominent situation in my life when I felt like an outsider was during my first semester at [college]. As an international student I had to adapt to not only new country, but also to a completely different academic system. . . . At the same time I had to also learn the everyday life in the US: how was it appropriate to meet people, what topics was it fine and not fine to talk about, who paid for the lunch in what situation, etc. The only benefits on my side were that I already knew the language on a somewhat decent level . . . and that I had traveled a lot and thus was mostly protected from being overwhelmed by the culture shock.

Social Class, Poverty, and Wealth

Several students specifically addressed how social class differences affected their experience of being an insider or an outsider. The examples they gave illustrated that many aspects of culture (e.g., behavior, values, housing, and clothing) can be affected by social class standing. Differences between developed and undeveloped economies were also recognized in their papers:

The beaches and homes in Dominican Republic are very different from the apartments that I walk through every day in Boston, MA. Seeing houses having tin roofs and also other forms of covering

was very interesting. I didn't know what to say. I was astonished, as when it rained all you could hear is the banging of the hard rain on the cold tin roof. At home you could only hear the rain if it is pouring and only hitting the windows, but here a mild shower can be heard as if popcorn popping.

A student from a poorer family wrote about the difficulty of attending a university where many of the students are from very well-to-do families:

As I got to learning about my new friends and classmates, I was stunned—beach houses, private educations, brand-new cars, money to buy everything from designer clothes to alcohol, and month-long trips to Europe. . . . Back home, I'd bought all my own clothes at the cheapest price available, re-used plastic water bottles, and searched the sale circulars whenever I was planning on making a purchase. It became very clear to me that now, I was the tourist, the outsider, the odd-man out. . . . There have been many occasions where money has been an issue for me at [college], especially in social situations: not being able to go out to eat, having to consider which places I could afford to go to on weekends, and having to buy my textbooks used online. There has been even more times where I've felt incredibly alone at [college], never remembering that not everyone is a business fanatic with a sailboat to their name.

Another student wrote about how he started off as an outsider in a new job, but then became an insider. Being accepted into the group of employees as an equal enabled him to learn about how their social class position was different from his and led to a different attitude toward their jobs:

The job became easier as I was able to settle into a routine that allowed me to excel at my position. The wait staff complimented my unrelenting work ethic and rewarded me by increasing the percentage of tips I received. Once I became an insider my perception about the employees changed drastically. I always thought the wait staff believed they were "above" assisting a kid and that's why they avoided helping me for weeks but as an insider I was able to see that their problems were far superior to my own. Many of the employees worked 6 days a week just to get by and I understood the pressures that this took on their lives. I always tried to have a positive attitude along with strong work ethic to make the lives of the waitresses a little bit easier. The employees at the restaurant became a second family to me after three short months.

These examples illustrate how being an outsider can increase a student's knowledge an awareness of social class differences and their impact on one's life.

Coping Strategies

In both the outsider and insider essays, students described techniques and strategies they used to cope with their outsider status or to help someone else become an insider. One foreign exchange student from Russia recommended getting to know the "natives" (in this case, students from the US) rather than segregating yourself among other foreign students. He recommended not being shy about asking questions and not feeling bad about making mistakes:

> When I just arrived in the US, I was really afraid of doing something completely wrong and as a result being criticized or even ostracized by the group I was trying to fit in with. In retrospective this fear was completely baseless. Even though I made a lot of social mistakes (such as refusing to tip in the restaurant, something that is absolutely normal in Russia, but apparently completely inappropriate in the US) I was never punished for them. My American friends laughed at me, questioned me, called me an idiot, etc. However no one stopped hanging out with me, just because I was making all these mistakes.

Another student recommended trying to learn at least a little of the language of the people you will be visiting or living with, and avoiding "hot button" issues such as religion and politics:

> Looking back, I am fascinated in how we all managed to keep our differences aside, and make everything else work. And I believe this was the key to the success of our relationships. We did not let politics, religious beliefs, norms, and traditions get between us. We all approached each other with an open mind, and we all supported each other to make the process of assimilating to a foreign environment more pleasant. Something that really helped us move forward is a tradition we started ourselves. Every Friday one of us is responsible for cooking something that comes from our native culture. This went on for the remainder of our freshman year, and it played a big part in us learning about each other and understanding each other's cultures.

The "insider" essay of a student from Jordan illustrated the importance of having an open mind and being willing to try new things when visiting a society not your own:

Anthony was very open-minded about his visit. He wanted to make the most of it by learning about the country, its culture, its language, its traditions, and even its food. He tried all the traditional dishes made in Jordan, some of which are not easy to eat if one isn't used to it. When I previously had visitors it would have been impossible to feed them sheep brain or tongue but, with Anthony, he was interested in trying them.

A Vietnamese-American student wrote about the importance of knowing and practicing local customs and ways of behaving politely: "After landing in Vietnam, my family and I were welcomed by our grandmother, cousins, aunts and uncles. As a sign of respect, I bowed and said hello in Vietnamese."

One student's insider essay described the efforts he and his friends made to welcome an exchange student and make him feel part of the group:

> Since Christo did not know anyone in the United States, we wanted to do whatever we could to make him feel comfortable and happy. We began including Christo in all our extracurricular activities, such as going to the beach, out in Boston, and Saturday cookouts at our friends. Luckily, it was not hard to connect with Christo because the two of us had a lot in common. The only time we happened to really disagree was when the United States was playing England in the FIFA World Cup soccer match.

Another student, who was an "insider" at a dance academy, described how the instructor guided the students to welcome and mentor new students:

> Throughout those many years of Irish Step Dancing, I have seen many students come and go but every time someone left, a new student would join us. At first it's weird when a new girl or boy joins us because the students who are already in the school have formed such tight bonds and friendships that it is difficult to open up but our instructor knows just how to welcome the new students. Our instructor, Michael, usually takes an older more advanced student and pairs them with a newcomer to show them the ropes and teach them a beginner step so that the new member won't feel out of place. I often am that student who works with the newcomers because I am one of the senior dancers in the school and a high ranked preliminary champion dancer so my practice time always runs over the beginner practice time. I always like having a new person join the group because it is nice to meet someone fresh. However, it is also sometimes difficult to incorporate them into certain dances just because

they don't know how things work yet. Whenever a new person joins the class, all the rest of my fellow dancers try to be welcoming and make the new dancers feel like they belong there.

Another student described the advantages of being an insider. As a returning camp counselor, she knew the routines and expectations and could accomplish them quickly and easily:

> I leisurely arrived at . . . "pre-camp" later than all of the other counselors. I knew that I had to move into the counselor bunks immediately, before any of the new counselors settled in. I knew exactly which bunk I had to move into in order to stay near all of my friends. I then had to visit to the office in the main house where I would find the co-directors. . . . They told me that I needed to move my things into a bunk, but I already done this because I have been through this process many times. [They] then asked me to hand out nametags to all of the counselors, new and old. I could easily pick the new faces out of the crowd because of their actions. They usually stood alone and were extremely quiet, taking in their surroundings. After this, my friends and I sat at the bench in the grove area. We were a closely-knit group. We had all been counselors with each other for a few summers, so we knew how things worked at Camp.

Benefits of Crossing Boundaries

Students described many of the benefits and insights they received from the experiences of being an outsider and of being an insider welcoming newcomers:

> I walked around a lot. Luckily, it was those moments that held me captivated by the beauty of Kenya. It was a world entirely different from mine. Although there are signs of the impoverished state of the country, I cannot help but feel amazed by the cultural experience.

In his insider essay, another student wrote about the experience of welcoming a new student at his high school into his group of friends:

> The best thing about bringing John into our group was that I now have six lifelong friends instead of five. I know he will always be there for me if I need him. . . . Our friendship has transcended high school and we remain friends to this day.

A student wrote in her insider essay how proud she was to have helped another student who had recently moved into her town to feel welcome at her new school and to make friends. This experience gave her insight into how hard it is to be new:

> I will never forget the day I met Jenny's mother. She came up to me at the end of our last game my junior year and thanked me. I had no idea why she was thanking me; but then she went on to say how she hadn't seen Jenny this happy since before they moved; and that joining the team was one of the best things for her. "She truly looks up to you and I want to thank you for making her feel welcome and part of this team." I was speechless. I don't know why but it never occurred to me that Jenny was also having a hard time fitting in at school as she adjusted to the move. I have never moved to a different town, so I never experienced being the new kid at a new school. I didn't realize how challenging it was for Jenny to integrate into a new school her freshman year of high school when girls are "cliquey" and "catty."

For a Mexican-American student studying in Italy, her experiences led to her ability to take the role of the other. She wrote in her outsider essay about an epiphany she had as she realized that under the many differences between the two cultures are some fundamental similarities:

> During *pranzo*, or lunch time, we would all gather at the table and feast on a great amount of food. . . . We would sit there and talk for hours and hours about everything imaginable, and then it all clicked: It was just like back home. I was surrounded by my host family, eating, having great conversation, just like I was used to with my family. It was then that I realized that the Mexican and Italian cultures weren't all that different.

A Korean-American student expressed a similar insight:

> I found that being stuck between two contradictory cultures, such as the South Korean and American ones, truly force one to accept that no one culture is perfect, and that there are only differences. There is no better or worse, no right or wrong.

These decentering experiences helped the students step outside their own culture and view it from the perspective of the outsider, thus leading to greater understanding of both cultures.

Discussion and Conclusions

Pedagogical Benefits of the Assignment

From the instructor's perspective, there were a number of benefits from the Outsider/Insider assignment,

the results of which informed our class discussions throughout the remainder of the semester. I briefly summarize some of the main positive outcomes next.

First, writing the Outsider/Insider papers provided students the opportunity to reflect on what they had learned about culture and cultural difference in class and from the course readings. Students learned to apply the definition of culture and its many components to their life experience to gain a solid understanding of the concept and its real world implications. They also had to integrate their own experiences in cross-cultural interaction (broadly defined) with this academic learning.

Second, the students learned to see beyond a particular culture and its characteristics to the fundamental underlying issue of recognizing difference and learning strategies for coping with it, both emotionally and interpersonally.

Third, the students learned about a range of challenges and about specific types of problems that can occur in cross-cultural encounters as well as specific ways of handling those situations.

Fourth and finally, the students practiced the skill of taking the role of the other in two ways: (1) they wrote about their own experiences being an outsider and then their experiences of being an insider so that they had to look at situations from others' points of view, and (2) their exposure to the experiences of fellow students in the class through the sharing of key excerpts of each paper enabled them to see both of these types of situations from their fellow students' perspectives.

Implications for Pedagogical Practices

Using teaching methods and assignments that ask undergraduates to integrate course materials with their own experiences can be an effective method of teaching cross-cultural understanding. Asking students to analyze the experience of being both outsiders and insiders helps them learn what the challenges of cross-cultural interaction are, and how cultural differences become relevant in everyday life and experience. By sharing excerpts from all the papers with the class, the students were able to learn from each other. Instructors could also use student responses to the assignment to deepen learning on any of the themes addressed. For example, a student's description of a strategy for coping in cross-cultural encounters could be used as a writing prompt for reflective responses. Students could be asked to conduct a survey of students on their campus (both foreign and domestic), asking them which of the coping strategies they find most effective. Student responses could also be integrated into the remainder of the course. For example, when covering social class differences and differences in wealth in developed and developing countries, the instructor could use student responses to this assignment as examples or as question prompts. The class could be asked to explain how the students' observations were similar to and different from the descriptions of cultural differences in social class given in course readings.

Applications in Other Disciplines

While the course in which I used this assignment was focused in building cross-cultural understanding, the Outsider/Insider assignment could be used for a variety of courses in global studies, sociology, psychology, or communication departments. For example, in a psychology course, the assignment could direct students to focus on emotional reactions and differences in personality in the people they encounter, while in a communication course students could be directed to focus on interactional style, preferences for verbal or nonverbal communication, gender differences in communication, and so on. Students in sociology courses could be directed to focus on the implications of race, class, and gender for outsider/insider status.

Further Research

Further research should be done to address the effectiveness of pedagogical techniques such as those used in this course on student's future success in cross-cultural encounters. As many of the students in this course were planning to participate in study-abroad programs, sections of the course in which students complete the Outsider/Insider project could be compared with sections without this assignment. Students participating in study abroad programs could be surveyed or interviewed about their experiences to see whether their awareness and ability to cope with cross-cultural encounters has improved relative to students who have not completed this assignment.

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The REEAL Model: A Framework for Faculty Training in Online Discussion Facilitation

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Discussion forums are a primary tool for interactions in the online classroom. Discussions are a critical part of the learning process for students, and instructor facilitation should reflect this importance. Effective instructor discussion facilitation encourages students, provides evidence and analysis and links the discussion to subsequent discourse. However, instructors receive little guidance in strategies to meet these expectations. To fill this gap, the REEAL Model is presented to support faculty in developing appropriate discussion responses. In addition, a transcript analysis technique is described which can be used as part of a faculty development program to ensure faculty have appropriate skills and background. The outcome of the process is faculty who are comfortable and confident developing discussion postings that align to learning outcome, provide meaningful, and facilitate ongoing conversation.

While emerging technologies have become more commonplace in online education, the discussion forum continues to be a critical component in student learning (Nash, 2011; Vlachopoulos & Cowan, 2010). The literature is replete with research on the effectiveness of online discussion forums (e.g., Brinthaupt, Fisher, Gardner, Raffo, & Woodard, 2011; Cranney, Wallace, Alexander, & Alfano, 2011; Nandi, Hamilton, Chang, & Balbo, 2012). Given this evidence, instructors understand that active, meaningful participation in the discussion requires more than a simple, cursory response to a few students and that their role is critical to the outcome of the exercise (Nash, 2011). Furthermore, faculty development specialists recognize that training opportunities for faculty facilitating the discussion forum need to be relevant and applicable to institutional expectations (Bonura, Bissell, & Liljegren, 2012). Still, institutions continually struggle to identify innovative and effective strategies to support faculty (Cariaga-Lo, Worthy-Dawkins, Enger, Schotter, & Spence, 2010). Guidance and structure for instructors from faculty development specialists with regard to what constitutes a substantive discussion forum response or how to develop one is typically minimal. Without clear direction, as Chang, Liu, and Shieh (2012) pointed out, the quality of the instruction, engagement of participants, and accuracy of the information in the online discussion forum are in jeopardy.

Background

As the discussion forum is perceived as a significant aspect of most online learning experiences (Nash, 2011; Vlachopoulos & Cowan, 2010), all stakeholders should understand how best to capitalize on the potential that asynchronous conversations have to enhance learning. Yet, discourse and disagreements about whether the instructor should participate, as well as the extent of that participation, continue to exist. For example, Comer and Lenaghan (2012) and Seo (2007) identified an incongruity in advice about instructor participation from no instructor involvement to robust participation. According to these authors, both strategies have challenges and benefits.

Despite the differing perspectives presented in the literature, instructor presence and interaction in the discussion board is being demonstrated as a salient aspect of learning. According to Nandi, Hamilton, and Harland (2012), students often ask questions in the discussion forums as a means to grasp subject matter and become better versed in the content. Through the instructor's acknowledgements of their understanding, clarifications and sharing of experiences, student learning was further impacted. Additionally, studies such as those conducted by Kalelioğlu and Gülbahar (2014) and Yang (2008) suggested that that the expert contributions of the instructor lead to increased critical thinking performance on the part of the students.

To make the most of these benefits and minimize the potential challenges associated with instructor facilitation, Arend (2009) suggested that participation should perhaps be less frequent but more purposeful. According Darabi and Jin (2013), the reduction of cognitive load in the discussion task increases the quality of the overall discussion. In other words, a more limited number of postings with high quality content seemed to be most conducive to student learning. Supporting this assertion, An, Shin, and Kim (2009) found that purposeful, less frequent instructor involvement led to an environment where students' interactions were more frequent and robust. Because of the potential for enhanced learning and the development of critical thinking skills (Brinthaput et al., 2011), a paradigm in which instructors consider how discussions should facilitated rather than how many posts they make or whether they should be involved at all may be the best compromise.

Active, meaningful participation in the discussion on the part of the faculty member is a complex process (Nash, 2011). The instructor has the obligation to create meaningful, substantive replies that focus on the course content, identify learning opportunities and bring a variety of perspectives to the conversation (Bedford, 2010). Furthermore, high quality faculty realize that "the instructor's role is not so much to lead students to a correct answer as to carry on a dialogue that helps develop deeper understanding" (Arend, 2009, p. 18). Yet, there exists little guidance for instructors to build their capacity to frame comments in the most effective way, provide meaningful feedback, and pose appropriate questions to support these expectations.

Purposeful Facilitation

Instructors can understand the importance of their engagement in the discussion forum and have a desire to help students reach higher levels of critical thinking but lack an understanding of how their role manifests in the asynchronous discussion. According to Wang and Chen (2010), poorly facilitated discussions can limit learning and stifle interaction among students. The REEAL model for discussion facilitation and its prerequisite analysis provides a framework from which instructors can build their discussion facilitation skills. It serves as a promising strategy to guide faculty in

reflection and analysis of the electronic conversation that results in high-quality, substantive feedback to online learners. However, because of the time commitment involved in the process of analyzing discussion data, it is suggested that the REEAL model be used within the framework of a faculty development strategy rather than an exercise in which faculty engage during the actual facilitation of a course.

A REEAL model discussion response incorporates five distinct features: reiteration, encouragement, evidence, analysis, and linkage (see Figure 1). It provides for clarity, learning, and extended conversation. First, clarity is achieved as the instructor reiterates (R) the part(s) of the students' discussion contribution that will be addressed. This is a central pedagogical strategy as the instructor identifies the content of the discussion salient to student learning. Next, the instructor incorporates emotional support (E^1) to the student by providing feedback that demonstrates what she has done well and how she can continue to build success in her learning.

Critical thinking and knowledge construction (Garrison & Archer, 2007; MacKnight, 2000; Paul & Elder, 2005) are addressed through a presentation of evidence (E^2) and analysis (A) that supports the conversation. Evidence is a broad category of information that can be brought to the discussion. What is considered appropriate evidence is based on a number of factors, including educational level, course

Figure 1
The REEAL Model for Discussion Feedback

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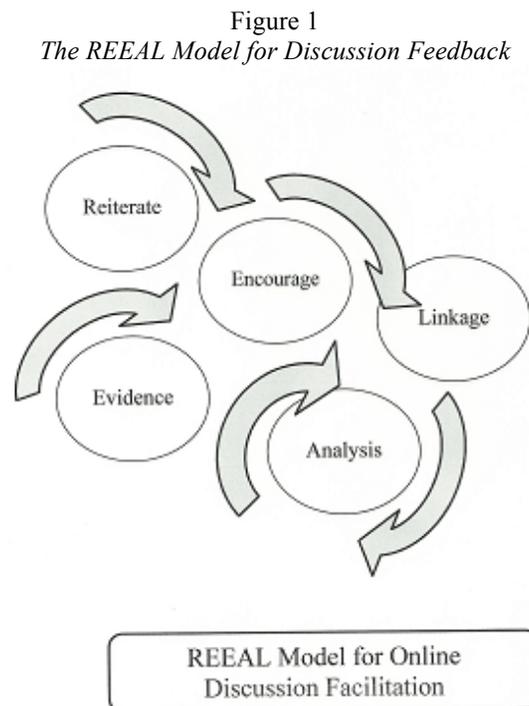
materials and students' level of expertise. For example, in a graduate course, appropriate evidence would likely include peer-reviewed research. Conversely, in a bachelor's level course, the instructor's practical experience in the field might serve as appropriate evidence. The flexibility of the REEAL module allows for faculty to make these decisions based on their experience, expertise, and knowledge.

As in any scholarly discussion, an analysis is a critical component of learning in that it that synthesizes the evidence presented with the course content. Analysis draws on students' critical thinking skills and helps students identify unique ways of thinking about the topic (Wrobleski, 2007). Analysis also allows for scholarly discourse that critiques the evidence in a way that it accounts for the conclusions articulated. These strategies situate the student to make her own judgments and create arguments based on the information presented. This is the basis for critical thinking which, according to Scharfersman (1991), allows students to come to reliable and trustworthy conclusions about the issues under consideration.

The final component of the REEAL framework for discussion feedback is linkage (L). Linkage is important because it has the potential to engage students in a peer-to-peer conversation, open the conversation to other students, extend the learning content to supplemental materials and/or build critical thinking skills in students. Questioning is one salient strategy instructors can use in the linkage component of the feedback. According to MacKnight (2000), questioning can "influence the depth of thinking that occurs . . . [and help students] go beyond facts and use knowledge" (p. 39). However, not all questions lead to critical thinking. According to Krathwohl (2002), questions asking students to analyze, evaluate, and/or create knowledge or information relates to higher levels of cognitive processing.

The linkage allows students to share the conclusions that they draw based on the instructor input and to engage with other students in a consequential way. This can guide the conversation from an instructor-centered activity to one in which important peer-to-peer interaction takes center stage (Nash, 2011; Vlachopoulos & Cowan, 2010). Linkage strategies can scaffold the learning for students who may have differences in expertise and lead to levels of reflection more aligned to individual situations (Akyol & Garrison, 2001). Some strategies for linkage in the REEAL model for discussion facilitation include,

- asking open-ended, Socratic questions;
- requesting that students consider and comment on a peer's, opposing perspective;
- introducing a new perspective to the conversation;

- recommending supplemental resources; and
- inviting additional students to join the conversation.

Using the REEAL model ensures that the faculty member has considered a variety of issues in her responses. It outlines the feedback that results from the use of a process that includes in-depth analysis of the discussion text and draws on content analysis techniques as described in subsequent sections. Discussion responses using the REEAL model will include one to three sentences aligned with each of the following:

- Reiteration (R): Tells the student what part of their response the instructor is referring to.
- Encouragement (E[1]): Acknowledges a student's effort, prior knowledge or critical thinking.
- Evidence(E^2): Shows students know how their ideas are juxtaposed to the course content, other resources, or practical application.
- Analysis (A): Provides students with issues to consider for further discussion and models critical thinking.
- Linkage (L): Provides context for continuing dialogue.

The result is a comprehensive, paragraph-style response to student conversation in the discussion board that extends the conversation, provides for analysis of appropriate evidence, encourages critical thinking skill development, and promotes on-going peer-to-peer conversation.

Faculty Training Using the REEAL Model

Instructors bring to the learning environment a plethora of experiences and perspectives about online teaching (Cariaga-Lo et al., 2010). This creates a need to construct a shared understanding of expectations (Bonura et al., 2012) and an organizational culture that sets a standard for faculty behavior in the classroom (Cox, 2012). These goals are best accomplished through relevant faculty development that respects participants' privacy, their time and their individual needs (Ahmed, 2013). Faculty development prepares faculty to fully engage in the learning experience with students and enhances their skills and ability (McKee & Tew, 2013). This translates into enhanced and improved student learning outcomes (Rutz, Condon, Iverson, Mandcua, & Willett, 2012) that aligns with contemporary student expectations (McKee & Tew, 2013).

As faculty become more confident and experienced in their discussion participation, developing REEAL

style responses to student interaction may become intuitive. For less experienced faculty, a series of developmental exercises implemented through a faculty development course or training event may be required in order to become skilled at robustly participating in discussions using the REEAL framework. For these faculty, there are several prerequisite steps that incorporate qualitative transcript analysis techniques (Garrison, Cleveland-Innes, Koole, & Kappelan, 2006) that help to identify and organize the content for the response. These steps can be purposefully practiced in a coaching or mentoring relationship between a faculty development specialist and a faculty member. As an alternative the REEAL strategy can be facilitated in a development or training course in order to assist faculty members in becoming competent. In addition, a reality of using the REEAL model may be that it is most useful for faculty with a background in qualitative research. The subsequent description of discussion transcript analysis assumes prior familiarity and understanding of qualitative data analysis. For faculty less competent with qualitative techniques, a pre-requisite refresher course might be necessary.

Analysis of Discussion Text

Learning to develop a REEAL style discussion response can be accomplished through the purposeful engagement in a number of steps that incorporate elements of qualitative transcript analysis as described by Garrison et al. (2006). This situates the discussion forum text as the data to be analyzed and requires that the faculty member consider the intended learning outcomes for the students. The first step in the analysis process is to identify the unit of analysis that will be the subject of the discussion response. Next, the data (discussion text) from the identified bounded system (unit of analysis; Yin, 2003) is organized using an appropriate analytic tool. This is followed by focused coding and categorizing. The culminating step is to develop the text of the discussion response using themes synthesized from the analysis within the REEAL framework.

Determine the unit of analysis. The first step is to identify a unit of analysis that reflects the student or group of students to whom the response will be addressed. Unit of analysis is described in the case study literature in many ways. According to Yin (2003), the unit of analysis is defined within the context of the interactions of the units themselves as well as how those interactions are carried out in real-life situations. Under this paradigm the unit of analysis could be made through an interpretation of the characteristics of the discussion being presented and aligns with Tellis' (1997) definition that suggests that it be referred to as a "system of action rather than an individual or group of

individuals" (para. 28). It also allows for evolving decisions about the nature of the feedback to be provided and results in flexibility in facilitation.

For example, in discussions in which students are asked to integrate course content with a current event, scholarly article, case study, or other external topic, the unit of analysis might be a group of learners with similar perspectives or who shared their opinion on a topic. The identified unit of analysis could be based on complementary or opposing opinions, or even levels of competency. Any number of combinations of responses may be the basis of the unit of analysis ranging from a dyad to a large group of students. The ultimate decision needs to be made by the faculty member based on her expertise and understanding of the issue. This provides the faculty member the opportunity to synthesize those perspectives into a single, flexible, meaningful description of the phenomenon as well as to lead the students to the next step in their understanding of the concept.

Table 1 is an example of a unit of analysis in which four student responses were selected based on their perspectives of discussion questions posed, which were: "Why is community important in the online classroom?"; "What are the benefits of creating community?"; and, "What are some strategies that you have (or could) use to create community in your own practice?" In this example, the unit of analysis was identified as a group of students with complementary interpretations of the course content and included their perspective of the original question, articulation of similar positions, and possession of varying levels of competence.

Focused coding. Garrison et al. (2006) described transcript analysis as involving the categorizing of thoughts and concepts into units followed by an analysis of patterns of communication. However, because the focus of the data analysis in discussion facilitation is not transferability or credibility, some of the steps in a traditional qualitative analysis can be excluded. Rather, the goal in this strategy is to focus on the accuracy and depth of the content of the discussion. Therefore, focused coding and categorizing, such as those described by Hahn (2007), are the preferred techniques. Additional systematic comparison approaches that focus on deductive coding techniques aligned with specific course content, such as those suggested by Patton (2002), are also appropriate. For example, in the discussion responses presented above, the instructor is looking for specific content to be addressed by students. This includes rationale for the importance of online discussion and examples from the course materials. In addition, since this is a graduate level course, she is expecting students to draw on and cite those course materials. These expectations result in the codes presented in Table 2.

Table 1
Example Unit of Analysis

Response	Example student responses
1	Good evening. The concept of learning community is important to the instructional process for a number of reasons. The article by Smith describes these reasons as enhancing learning and leading to increased retention. The Canby article also added that it helps develop critical thinking skills. In my own practice, I try to develop a sense of community in my online courses by incorporating icebreakers in the first week of the course. Students seem to like this and I get a sense that they make connections that last throughout the term. This would be supported by Smith's discussion regarding how relationships are part of the process. -Juliet
2	Hi, I always develop learning communities in my classes. I encourage the students to interact frequently, and I e-mail those that aren't participating. Usually, after I contact them they start to engage in the discussions and feel more like part of the community. -Shannon
3	I think that learning communities are important. Without learning communities students might feel isolated and might not complete the course. There are many ways to nurture learning communities. -Sayid
4	Dear Fellow learners. According to Smith (2008) learning communities can be described as a "sense of belonging and cohesion in the learning process" (p. 98). Drawing on Canby's (2010) contributions, I would also add that learning communities work to draw out critical thinking, empathy, and consideration for multiple perspectives. While all of these considerations lead to higher levels of learning, the latter can also be used to build greater levels of scholarly skills that can be transferred to other academic environments. Quite honestly, I've never thought about online interaction this way, but as I analyze my own practice I see that I do many of the things suggested like include ice-breakers, ensure that students have a place for informal discussion and encourage robust interaction. Upon reflection of the readings for r this week, I've made a decision that I am going to be more cognizant of how I'm incorporating these strategies into my courses and ensure that they are systematic and purposeful. Thanks for the great ideas. -Bernard

Note. Four student responses were selected based on their perspectives of discussion questions posed.

Table 2
Focused Coding of the Example Discussion

Comment	Code
The concept of learning community is important to the instructional process for a number of reasons	
The article by Smith describes these reasons as enhancing learning and leading to increased retention	Smith
The Canby article also added that it helps develop critical thinking skills	Canby
In my own practice, I try to develop a sense of community in my online courses by incorporating icebreakers in the first week of the course	Icebreakers
This would be supported by Smiths' discussion regarding how relationships are part of the process	Smith, relationships
I always develop learning communities in my classes	
I encourage the students to interact frequently and I e-mail those that aren't participating	Frequent interaction
Usually, after I contact them they start to engage in the discussions and feel more like part of the community	
I think that learning communities are important	
Without learning communities students might feel isolated and might not complete the course	Combat isolation, retention
According to Smith (2008) learning communities can be described as a "sense of belonging and cohesion in the learning process" (p. 98)	Smith
Drawing on Canby's (2010) contributions, I would also add that learning communities work to draw out critical thinking, empathy, and consideration for multiple perspectives	Canby
While all of these considerations lead to higher levels of learning, the latter can also be used to build greater levels of scholarly skills that can be transferred to other academic environments	Scholarly skills that are transferable
Quite honestly, I've never thought about online interaction this way, but as I analyze my own practice I see that I do many of the things suggested like include ice-breakers, ensure that students have a place for informal discussion and encourage robust interaction	Icebreakers

Note. All sources cited in the examples are fictional.

Categorizing. Similar to other qualitative analysis procedures, the next step in the process is to organize the codes into categories (Corbin & Strauss, 2008). The purpose of the category development in discussion facilitation is multifaceted. First, the categories can be used to confirm or disconfirm initial decisions about how to organize the units of analysis. For example, informal analysis that identified an overlapping of ideas that could be compared and contrasted may have been envisioned by the instructor. However, as a result of more formal analysis, other issues more important to the content of the course may be uncovered. The result might be that the instructor may choose to eliminate some students from the unit of analysis and/or select others from the class. In addition, if outlying topics presented by students are tangential, the instructor may choose to give them a perfunctory mention or eliminate them in the feedback response all together.

To ensure that learning objectives are being met at this point, the instructor will also need to compare the analysis of the discussion content to the learning objectives for the course or module. This will help the instructor identify gaps in the discussion related to learning outcomes, correct misunderstandings of course content and highlight salient content. With regard to the example presented, codes were organized into three categories—sources, importance of community, and strategies for building community—based on a deductive coding strategy in which the instructor specifically mined the data for these references. Table 3 illustrates how each student's discussion posting reflected these three categories in ways that could be compared and contrasted.

In addition, the instructor added memos, as described by Corbin and Strauss (2008) and used them to highlight key issues throughout the analysis. These memos serve as reminders about specific gaps, outcomes and content that the instructor wants to remember to capture. In addition, the instructor can use self-reflection through methodical questioning of herself to address her own experiences, knowledge and perspectives. This can help her identify how her

personal opinions and expertise outside the course content might be included, if appropriate, to expand on the issues presented by the learners. Once the preliminary steps of determining the unit of analysis, engaging in focused coding and identifying the categories are complete, the development of meaningful feedback can be a straightforward process using the REEAL model.

Developing a Meaningful Response Using the REEAL Model

Figure 2 applies the REEAL model to the example discussion. Note how each component has one to three aligned sentences but, when combined, creates a fully developed paragraph with logic and conversational flow. Specifically, the example starts by addressing the students included in the original unit of analysis followed by a summary of the issues that will be addressed in the instructor's response (reiterate, R). Next, the instructor offers praise for the student's ability to identify these concepts as key (encouragement, E^1). This is followed by a discussion of how the students applied the course content to their discussions (evidence, E^2), and mentions the gap with regard to the one resource that was omitted from the conversation. In addition to the instructor's reference to this source, she also describes its importance as well as additional ideas that the group needs to consider (analysis, A). Finally, the instructor poses two inquiry-type, Socratic questions designed to stimulate further conversation (linkage, L).

Considering a group of students as the unit of analysis provides for the kind of synthesized feedback that facilitates ongoing discussion and continued interaction among learners (Bedford, 2010). It is most appropriate for discussion stems that require students to form an opinion, articulate a perspective, apply course content or share an experience. This is the type of discussion that promotes more interactive, reciprocal conversations (Ke, 2013) and the development of higher-order thinking skills (McLoughlin & Mynard,

Table 3
Category and Code Development of the Sample Discussion

Categories	Codes	Memos
Sources	• Smith	No references to the Johnson article
	• Canby	
Importance of building community	• Relationships	
	• Combat isolation	
	• Retention	
	• Skills development	
Strategies for building community	• Icebreakers	Additional strategies: Sharing experiences, negotiating
	• Frequent interaction	meaning, exchanging of resources and perspectives

Figure 2
Example Response using the REEAL Method

Juliet, Shannon, Sayid, and Bernard,

R: You all described the importance and benefits of building community in your postings. Two of the strategies you identified as important to building community are the use of icebreakers and frequent interaction. In addition, you described these strategies as leading to the developing of relationships between/among learners, combating isolation, improving retention, and scholarly skills development.

E^1: These are all effective ideas in ensuring engaging, meaningful discussion in your online class, so I'm pleased that you focused your responses on this topic.

E^2: Bernard and Juliet, you both pointed to the Smith (2008) resource to support your conclusions. In addition, Bernard, you also brought Canby's ideas to the conversation. Good job. However, I'd like to also point you to the other required reading, Johnson (2012) as also indicating some suggestions that could lead towards effective community building.

A: These include sharing experiences, negotiating meaning, exchanging of resources and identifying alternative perspectives. While I think that icebreakers and frequent interaction could certainly lead to these goals, I think that there are others that we might consider.

L: For example, what characteristics should our frequent interaction possess? Should our interactions be primarily with individual learners or should they support the interaction among them?

-Your Instructor

2009). There are times, however, when instructors will not be able to synthesize the content based on identified patterns—they simply do not exist. In these cases, the instructor may choose another strategy or decide not to comment at all.

The response identified the unit of analysis and synthesized their contributions in a meaningful way. Those ideas were compared, contrasted and differentiated, drawing on analysis techniques from the qualitative research literature. Additional perspectives based on the expertise of the instructor were included, as were questions designed to expand opportunities for student engagement and subsequent learning. In addition to a dialogue that centered on the emergent themes, students were referred to by name, which according to Levine (2005), is important in crediting them for their unique contributions and building on those ideas presented.

REEAL Model Responses: Additional Considerations

In some instances, an individual learner might have a unique idea, a misunderstanding or an underdeveloped response. In this case, the unit of analysis can be considered the individual learner. While the consequences of an instructor response to an individual learner may be the suppression in learner interaction (Comer & Lenaghan, 2012), there are times when the risk is necessary to focus on correction, encouragement, suggestions for improvement or requests for clarification.

This may be especially true when learners are engaged in brainstorming or assignment development activities. In this situation, individual feedback might be necessary so that the learner's unique needs and strengths can be identified. An example of feedback to an individual learner who needs guidance on an assignment development discussion exercise using the REEAL model is shown below:

Kate,
Nice job on your draft. I appreciate that you brought in citations from the course resources and you effectively synthesized your own experiences with these resource (E^1). Before you make your final edits prior to submission, I would encourage you to take another look at the instructions (R). While you've provided a detailed response to Part I, Part II needs some additional development (A). Note that you are asked to include an example from your experience (E^2). I don't see where you've included this (A). If you need some help, refer to pages 66-67 in the text where it describes how to incorporate a personal example (L).
-Your Instructor

In this example, the single student—"Kate"—was considered to be the unit of analysis based on her individual need for direction about the course assignment. The individual feedback to Kate included support and encouragement, but also specific analysis

about what she needs to do to fulfill the requirements of the assignment. If Kate were the only learner in the class with this issue, it would be appropriate to offer her individualized feedback. However, if other learners demonstrated this same deficiency, a larger unit of analysis might be explored.

Opportunities to consider the entire class as the unit of analysis are also often presented in the discussion. In these cases, an overall summary directed at the entire class might most appropriate. Whole-class summaries may include a synopsis of ideas presented throughout the individual postings, the instructor's perspective on the topic, additional resources related to the topic or guidance on how the topic applies to previous or subsequent course concepts. Considering the whole class as a unit of analysis is appropriate in instances including those in which individual student postings have maximum or minimum diversity or when the instructor's input might hinder other feedback such as in peer reviews (Bedford, 2010). An example of a summary statement considering the entire class as the unit of analysis follows:

All,
I've appreciated reading your peer-reviews and found your advice to be appropriate (E^1). Some of the issues that you brought forward included: (1) ensuring that you provided examples for how to build learning communities in addition to describing your theoretical framework, (2) connecting the notion of learning communities to our prior discussions about adult learning principles, (3) including citations from the discussion section in the application to create a cohesive paper, and (4) attending to issues of APA. (R)

In addition, some of you suggested that your fellow learners include some background information regarding the organization to which you've applied the concepts (R). Remember that the intent of the assignment is to describe how you would apply what we learned about leaning communities (E^2). While this might be helpful to the reader, it is not a required part of the assignment (A). As we move forward with the peer-reviews it is important to ensure that we are directing our colleagues to the rubric and specific instructions so that all of us can meet the expectations of the assignment (L).
-Your Instructor

In this example, the instructor found a misconception being perpetuated and so included a corrective statement without naming any individual students within a REEAL framework response. This strategy allows the learner to determine how the feedback he/she received should be addressed in the final submission of the assignment. It also provides opportunities for other learners to reassess their own work to determine if they have met the standards outlined in the summary.

Conclusion

While technologies to support online learning are continually emerging and developing, the discussion board endures as the primary mode of classroom interaction (Nash, 2011; Vlachopoulos & Cowan, 2010). This situates the discussion board as a key vehicle in learning outcomes. These include higher levels of critical thinking by students (Arend, 2009), enhance individualized learning experiences for students (Du, Yu, & Olinzok, 2011) and assurance of appropriate knowledge construction (Hew & Cheung, 2011). To be effective, the discussion board must be an environment that fosters student engagement with faculty, peers, and content (Brinthaupt et al., 2011). To accomplish these tasks, balanced and appropriate facilitation by an instructor is essential.

The development of faculty skills in discussion facilitation using the REEAL model as part of a comprehensive faculty development program has the potential to provide the framework for faculty skills that novice and experienced instructors need to engage in robust electronic conversations with students. The strategy aligns with evidence that suggests faculty engagement and dynamic interaction in the discussion area will lead to enhanced learning (Darabi & Jin, 2013; Kalelioğlu & Gülbahar, 2014; Nandi et al., 2012; Yang, 2008). In addition, anecdotal evidence from faculty suggests organizational guidelines for substantive feedback generally lack detail and structure. Faculty who have used the REEAL framework to build skills in discussion facilitation have cited positive reaction from students and more engaging conversations.

The time commitment to become skilled in using the REEAL model can be of concern. However, the potential for the REEAL model to lessen the burden on faculty in their discussion contributions is significant as the model provides a way to develop fewer responses to more students in a meaningful way. This, in turn, reduces the burden on the students to review numerous entries, which leads to a more positive experience (An et al., 2009; Arend, 2009; Darabi & Jin, 2013).

Yet the REEAL model continues to be a theoretical framework for discussion facilitation based on best practices and extrapolated empirical evidence with regard to student learning in the online environment. Given that the discussion forum will likely continue to be a key component of the online classroom experience for the foreseeable future, research focused specifically on the REEAL framework could provide insight into unique learning opportunities that instructors have with their students. Empirical data, juxtaposed with

anecdotal and extrapolated evidence, could better support and guide instructors in their pedagogical practices within the context of the REEAL framework and inform instructors on how best to use their time to meet students' needs.

Clearly, in order for instructors to be effective in their interactions with students via the discussion board, their contributions must be purposeful and targeted towards student learning outcomes (Bedford, 2010; Brinthaput et al., 2011; Kalelioğlu & Gülbahar, 2014; Nash, 2011). As institutions continue to use the discussion forum as a salient learning opportunity for students, faculty development needs to be aligned with clear expectations and guidance for instructor performance. The REEAL model for discussion feedback and its associated strategies could provide the framework for organizations to support faculty in understanding expectations and developing the skills for implementation.

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Reviewing to Learn: Graduate Student Participation in the Professional Peer-Review Process to Improve Academic Writing Skills

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Although expectations for graduate students' writing abilities are high, their actual writing skills are often subpar (Cuthbert & Spark, 2008; Singleton-Jackson, Lumsden, & Newson, 2009), even though academic writing is considered integral to graduate education and necessary for career preparedness (e.g., Mullen, 2006; Stevens, 2005). Today's scholars in any field must be prepared to communicate findings effectively to a variety of audiences and venues. As such, explicit support in academic writing and communication skills at the graduate level is vital, and yet this area of support is often neglected in graduate level programs (e.g., Pfeifer & Ferree, 2006; Surratt, 2006). Thus, we propose engaging students in the professional peer-review process to nurture this skillset. In this paper, we present support for and practical implications of involving students in the professional peer-review process, where graduate students serve as initial reviewers in double-blind (or similarly robust) review procedures for refereed journals. We discuss theoretical and empirical support for incorporating professional peer-review activities to facilitate growth in graduate students' academic writing skills and productivity, including constructivist theory, examining examples and non-examples, working within the zone of proximal development to engage in deeper levels of learning, and utilizing general student peer review to improve writing skills. Finally, we present a framework for incorporating this form of peer review into graduate programs across disciplines.

Although expectations for graduate students' writing abilities are high, faculty and researchers across disciplines have agreed that graduate students' actual writing skills are often subpar (Cuthbert & Spark, 2008; Diehl, 2007; Lavelle & Bushrow, 2007; Singleton-Jackson, Lumsden, & Newson, 2009). Further, it is widely acknowledged that academic writing is integral to graduate education and necessary for career preparedness (e.g., Bacon & Anderson, 2004; Fischer & Zigmond, 1998; Mullen, 2006; Singleton-Jackson et al., 2009; Stevens, 2005), and while academic writing skills may be considered more or less significant depending on the field of study, writing is central to any graduate program. Fischer and Zigmond (1998) posited four skills integral to graduate student success, the second being written communication skills, or, more "specifically, being able to convey the results of one's work through publications and oral presentations" (p. 30). Today's scholars in any field must be prepared to communicate findings effectively to a variety of audiences and venues, including peer-reviewed journals, conference presentations, practitioners, legislators, and grant funders. As such, explicit support in academic writing and communication skills at the graduate level in various disciplines is vital, and yet this area of support is often neglected in graduate level programs (e.g., Bacon & Anderson, 2004; Fischer & Zigmond, 1998; Pfeifer & Ferree, 2006; Rose & McClafferty, 2001; Singleton-Jackson et al., 2009; Surratt, 2006).

Improving graduate students' formal academic writing is particularly important, as scholarly writing and publication in refereed venues play paramount roles in both graduate education and graduate students' eventual careers (Kamler, 2008). Utilizing a practice-based approach that enables graduate students to participate in the publication process is ideal (Doyle, 2008), as productive student publishers more likely become productive scholars (Kamler, 2008). Thus, we propose engaging students in the professional peer-review process to nurture this skillset. In this paper we present support for and practical implications of involving students in the professional peer-review process, where graduate students serve as initial reviewers in double-blind (or similarly robust) review procedures for refereed journals. Our personal experiences as graduate student reviewers encouraged us to present this pedagogy here and we hope to encourage others to utilize this practice, which, in our experience, has the potential for affecting positive outcomes.

We construct the foundation of our argument for student participation in the professional peer-review process by first summarizing research and theoretical evidence concerning (a) the state of graduate students' writing skills compared to expectations and (b) the importance of academic writing in graduate school and beyond. Then, we discuss theoretical and empirical support for incorporating professional peer review activities to facilitate growth in graduate students' academic writing skills and productivity. Finally, we present a framework for incorporating this form of peer review into graduate programs across disciplines.

The State of Graduate Student Writing

The current expectation in graduate programs is that students will write as professional scholars and that they acquired this skill prior to their admittance

(Mullen, 2006; Singleton-Jackson et al., 2009). The reality, however, often does not meet this expectation (Singleton-Jackson et al., 2009) and little appears to be done to remedy the apparent discrepancy.

Several researchers have investigated the state of graduate students' academic writing skill levels. For instance, Singleton-Jackson et al. (2009) administered the SAT II: Writing Test, Part B writing—an assessment used to measure high school students' writing prior to college admittance—to students in US graduate programs (PhD and EdD), the majority of whom completed over 24 graduate credits prior to the assessment. Results suggested that graduate student scores were comparable to those of high school seniors. Similarly, Alter and Adkins (2006) addressed the writing skills of graduate students in social work programs. They found that approximately 25-30% were unable to pass a basic writing assessment, and demonstrated considerable academic writing deficiencies in direct contradiction to reported writing expectations (Alter & Adkins, 2006). Particular difficulties were linked to basic mechanical issues associated with paragraph organization and clarity, and utilizing evidence to build a focused case (Alter & Adkins, 2006). As building an argument based on evidence from text is often a staple of academic writing for professional scholars and in graduate programs, we posit that these findings depict barriers for many graduate students in attaining success academically and, eventually, as professionals.

Instructional Programs

Due to this evident lack of writing skill, some have argued for more direct writing instruction at the graduate level (e.g., Fischer & Zigmond, 1998; Lavelle & Bushrow, 2007; Surratt, 2006). Integral to improving graduate students' writing skills is explicit instruction designed to support students in developing their undergraduate-level writing skills into skills appropriate for the complexity of writing expected in graduate school (Lavelle & Bushrow, 2007). Gibbons and Farr (1998) noted that poor writing skills are not limited to students and recently graduated PhDs, but have also, unfortunately, described some senior faculty. As such, they called for graduate programs to "acknowledge the problem of flawed writing and begin to respond to it in a systematic way" (Gibbons & Farr, 1998, p. 468).

Several writing programs have been implemented at the graduate level (e.g., Cuthbert & Spark, 2008). However, it appears that, although some disciplines and specific programs have offered courses in written communication skills, the practice is not a cross-disciplinary staple. Researchers have examined the implications of specialized courses and programs aimed at improving both graduate and undergraduate writing skills through the use of several instructional strategies, such as peer review and peer writing assessment (Cho, Schunn, & Wilson, 2006; Whitehead, 2002), explicit instruction of structure and process (Lloyd, 2006), providing detailed feedback (Bacon & Anderson, 2004), co-authorship (Kamler, 2008), and repeated practice (Johnstone, Ashbaugh, & Warfield, 2002). However, in general, we found that these programs are not as prevalent as the stated need would suggest necessary, and few programs have been implemented to directly address and assuage the widespread concern.

Implications

These arguments for improved writing withstanding, we offer a question: What are the implications of poor academic writing skills left untended? Maintaining high expectations for potential, future, and present faculty members is a concern applicable to most areas of study (e.g., Staudt, Dulmus, & Bennett, 2003; Surratt, 2006). However, graduate students with little experience or skill in academic writing eventually move forward from graduate school to become academics or professionals where effective writing is essential to professional success and participation in the culture of academe (Staudt et al., 2003; Surratt, 2006). Graduate students pursuing research-oriented degrees in particular are expected to contribute to their fields through scholarly publication. However, research suggests that lack of direct experience with the task can breed anxiety, which can further impede growth in academic writing skills (Bloom, 1981, Kamler, 2008) in turn exacerbating the problem. Thus, focusing on improving writing and research skills at the graduate level is important for the success of these students as future professionals and as contributors to their fields of study (Staudt et al., 2003).

Proposed Solution

Researchers have demonstrated that many graduate students lack publishable writing skills and often fail to develop these skills throughout their graduate careers. In response to this clearly stated concern, we propose a solution that engages graduate students in the professional peer-review process to support them in improving not only their scholarly writing skills, but also their learning, higher-order thinking processes, and *transfer* of knowledge—one of the primary goals of higher education (Halpern & Hakel, 2003)—from coursework to professional venues. As Wood, Bruner, and Ross (1976) posited, "the learner must be able to *recognize* a solution to a particular class of problems before he is able to produce the steps leading to it without assistance" (p. 90). As such, engaging in the peer-review process, or recognizing scholarly work as

well as areas for improvement, may be an important step for graduate students when developing independence in their scholarly writing (Reynolds & Thompson, 2011). Thus, the professional peer-review process (i.e., that which is specifically for the acceptance or rejection of academic journal articles) can serve as part of the scaffolding process of learning to write in a scholarly fashion. Existing programs designed to improve writing at the graduate level, as far as we have determined, do not provide opportunity for the type of experiential learning we propose through reviewing manuscripts submitted for publication.

Theoretical and Empirical Support for Peer Review

Although research has begun to shed light on this issue, there is little to no information regarding graduate student participation in the professional peer-review process, or whether this participation can successfully strengthen academic writing skills. It is important to note that, in this paper, we argue for the full participation of graduate students in the peer-review process. Engaging students in evaluating manuscripts submitted for publication is not the same as giving students a few example articles for the purpose of "pretend" evaluation. Although participation in this process often should *begin* with one or two "practice run" reviews, there is reason to suggest that the student's participation will be more authentic, and the learning more profound, if it is understood that the student's evaluation will have real-world implications (i.e., it will impact whether or not an article is accepted or rejected; e.g., Jones, 2009; Wigfield & Eccles, 2000).

The purpose of this section is to explicate a four-part argument supporting the need to begin a discourse on this topic and ultimately evaluate the effectiveness of this approach. First, we use constructivist theory—specifically radical constructivist and sociocultural theory—as frameworks to discuss the importance of learning through personal, yet logical, constructions. Second, we apply the importance of exposure to both examples and non-examples to graduate student writing skills (Bruner, Goodnow, & Austin, 1956; Doolittle, 2000). Third, we frame participation in the peer review of journal articles as an opportunity for students to work within an appropriate zone of proximal development (Chaiklin, 2003; Vygotsky, 1978) and to engage in deeper levels of learning such as evaluation and synthesis (Bloom, Englehart, Furst, Hill, & Krathwohl, 1956). Fourth and finally, we apply recent research on the use of general student peer review to improve writing skills to this concept and argue for continued investigation (Cho & Cho, 2011; Cho et al., 2006; Couzijn, 1999).

Implications for construction of knowledge. The radical constructivist von Glasersfeld (1984), quoting Giambattista Vico's *verum ipsum factum*, asserted that we only truly come to know what we make for ourselves. Only then do we understand the component parts and how they were assembled (von Glasersfeld, 1984). This concept lends itself well to the issue under consideration. Graduate students may be told, within classrooms or by their mentors, what is necessary for quality academic writing. However, some have argued that language is not sufficient to transfer conceptual structures from the expert to the novice (von Glasersfeld, 1998), and this knowledge will not become fully integrated, or implemented, until students have the opportunity to construct personally meaningful, yet valid, understandings of what it means for them to be a "good" writer. We suggest that participating in the peer-review process can provide this opportunity. It allows students to interact with academic writing and apply and re-evaluate their current understandings of good academic writing technique. The activity provides students with the space to construct their own meanings, which increases the likelihood that these meanings will be retained and used in the future. This participation also requires graduate students to interact with an important artifact within the culture of academe (i.e., the manuscript for review) and it is truly a dialectic relationship.

The graduate student's understanding is further constructed through interaction with the manuscript, while at the same time the manuscript is further impacted by the student's current understanding. This aligns with John-Steiner and Mahn's (1996) assertion that "the individual constructs the social and at the same time the social constructs the individual" (p. 196). Through the dialectic nature of professional peer review, graduate students continually evaluate and re-evaluate their own understandings of good academic writing. This provides students with the opportunity to expand on and refine novice understandings until this knowledge eventually matures into more expert understandings of academic writing. Using both radical constructivism and sociocultural theory as a framework, we argue that the professional peer-review process can contribute to the development of graduate student writing skills by requiring them to construct their own meanings and necessitating interaction with important artifacts of academia.

Importance of examples and non-examples. The importance of interaction with artifacts is related to the second aspect of the current argument: exposure to examples and non-examples. The theory of concept attainment (Bruner et al., 1956) is well established and applies to the topic at hand. The learner acquires concepts, both simple and complex, through exposure to examples and non-examples (Bruner et al., 1956; Doolittle, 2000). One of the factors affecting the ease with which a concept is attained is the complexity of the rule set that is used to judge the concept (Bruner et

al., 1956; Doolittle, 2000). When applied to graduate student writing skills, one can deduce that in order for students to understand the concept of good writing, they must be exposed to both good and bad examples of writing. In a classroom setting, however, graduate students are usually only exposed to examples of good writing in the form of primary sources and articles given as reading assignments and written by experts in the field who have already honed their writing skills. This neglects the non-example aspect of concept attainment. Participation in the professional peer-review process offers exposure to examples and non-examples alike; as any experienced reviewer knows, not all articles submitted for publication are worthy of publication. By evaluating both publishable and non-publishable work, we posit that graduate students can strengthen their conceptual understanding of quality writing. Further, the complexity of the rule set determining good writing makes this concept more difficult for learners to acquire (Bruner et al., 1956; Doolittle, 2000). As opposed to concepts involving simple rules alone, writing skill involves a host of conjunctive, disjunctive, and relational rules (Doolittle, 2000). Extended interaction with these rules gives graduate students the opportunity to develop a more complete understanding of quality writing.

Working within the zone of proximal development. The third aspect of the current argument is based on Vygotsky's (1978) *zone of proximal development*. The development of publishable writing skills is a crucial aspect of graduate student development, as this is a skill required for their future work. Although many graduate students have the opportunity to peer-review other graduate students' work in the context of class work, this is less likely to help them move toward a professional, publishable writing ability. Although graduate students may not yet have strong writing skills, the zone of proximal development encourages educators to focus on maturing skills and understandings, as opposed to skillsets that already exist (Chaiklin, 2003). When graduate students participate in the professional peer-review process, they are evaluating the work of individuals who will shortly be their peers in a very real sense. Interaction with submitted articles can help students successfully transition to a professional level of writing (Chaiklin, 2003). This interaction, which is understood to hold real-world implications (acceptance or rejection), also encourages deeper levels of learning (Bloom et al., 1956; Halpern & Riggio, 2003). Through the peer review process, students must engage in higher-order thinking processes, or *critical thinking*, which

> describe[s] thinking that is purposeful, reasoned, and goal directed—the kind of thinking involved in solving problems, formulating inferences, calculating likelihoods, and making decisions,

when the thinker is using skills that are thoughtful and effective for the particular context and type of thinking task. (Halpern & Riggio, 2003, p. 6)

Graduate students must synthesize their understandings of writing skill and then use this knowledge and skill to evaluate examples of writing and make a decision affecting manuscript acceptance, leading to more thorough or critical understandings of academic writing (Bloom et al., 1956). The application of the zone of proximal development to this example does assume the availability of assistance for the graduate student undergoing this process, either from a journal editor or faculty mentor. Obtaining feedback on "trial run" reviews and on subsequent reviews that prove challenging is an important aspect of the success of this approach.

Peer review as an instructional strategy. In addition to the theoretical foundations of this argument, research is emerging which suggests that serving as a professional peer-reviewer can indeed lead to improved writing skills. Much of this research investigates the use of general peer review within a classroom context (e.g., Cho & Cho, 2011; Cho & MacArthur, 2011; Cho et al., 2006; Reynolds & Thompson, 2011). Peer review in this context is defined as "the structuring of a process to allow peers to review each other's professional processes and/or products with the goal of improving such processes or products" (Woolf & Quinn, 2001, p. 22). What we suggest places graduate students in the role of "peer" to those who submit original research for review in a professional venue. Thus, students become participants in the professional activities for which they will be expected to assume as professionals and during their tenure as graduate students. Cho et al. (2006) investigated the validity and reliability of peer reviews and peer-generated grades. They found that, although students estimated that reviews and grades generated by their peers would be significantly less reliable than those of their professors, the reviews and grades that students actually generated were highly reliable and valid. These students received guidance on peer reviewing and used rubrics to generate grades (Cho et al., 2006). This study is relevant to our present argument because it can allay a predictable concern among journal editors: that graduate student reviews will be of a lower quality and less reliable than those of degreed professionals. As such, this study suggests that, despite their graduate student status, the resulting reviews of submitted articles will likely be of equal caliber to those already holding a degree.

Research by Cho and Cho (2011) and Cho and MacArthur (2011) made further contributions that are relevant to the present article. Within both of these studies, the researchers found that participating in a peer-review process in a classroom context improved the writing ability of the students who conducted the

reviews and those students who received the feedback. The students were reviewing the work of others in their courses, which is arguably different than reviewing the work of one who is not a peer or colleague. That being said, this research suggests that it is worthwhile to investigate the use of professional peer review as a means to improve graduate students' writing skills. Although this would involve reviewing work of those who are not peers, graduate students will soon become professionals and obtain this peer status. As it has been demonstrated that peer review is beneficial to the reviewer's writing skills, and that some training results in highly reliable and valid reviews, it becomes clear that more information is needed to determine whether professional peer review can truly improve the writing skills of graduate students.

Practical Implications

Our purpose is not to disseminate research, but to propose a method that may be worthy of future research endeavors. As such, in this section we offer suggested guidelines for formally engaging upper level graduate students in the professional peer-review process. These proposed strategies are derived from educational research, theory, and best practices, as well as our personal experiences with the task as veteran reviewers who engaged in the professional review process as PhD students. The role we propose for upper-level (e.g., doctoral) graduate students is as initial reviewers in a double-blind peer-review procedure for a mid-tier journal in their area of study. We propose the following be inherent to any program in which graduate students act as reviewers for professional journals:

- Reviewed manuscripts are within each student's area of study and/or reflect their prior experiences.
- Student agreement to review each manuscript is obtained in advance.
- One or two practice reviews are completed with constructive feedback prior to an actual review.
- Faculty and/or journal editors support students interpersonally and provide access to external supports.

Each of these points is discussed in greater detail in the following sections and involves the concept of *scaffolding*, or

> the process that enables a . . . novice to solve a problem, carry out a task or achieve a goal which would be beyond his unassisted efforts. This scaffolding consists essentially of the [expert] "controlling" those elements of the task that are

initially beyond the learner's capacity, thus permitting him to concentrate upon and complete only those elements that are within his range of competence. (Wood et al., 1976, p. 90)

By providing these scaffolds to graduate students as they participate as novice initial reviewers, several potential issues are assuaged. For instance, as the student's level of expertise is still in development, it is likely inappropriate for them to be responsible for issuing final decisions concerning manuscript acceptance. This potential problem can be avoided with professional support and clear guidelines during each step (especially initially), a built-in system in which the reviewed manuscripts represent areas of individual expertise, and a process whereby final reviews are approved by editorial staff. Another concern pertains to students' potential anxiety in making lasting decisions about others' scholarly work. Such ingrained scaffolds as we suggest here will support their confidence and perceived competence in decision making, especially considering that another with greater expertise (e.g., the managing editor) ultimately makes the final decision. We suggest that one or more expert reviewers (e.g., faculty mentors, editorial staff) should facilitate this guidance. We recognize that this requires a specific type of relationship, environment, and intrinsic support system wherein journal editorial staff are available to facilitate student reviewers.

Tailoring to Areas of Expertise

We suggest that it is essential to insure that manuscripts for review are within each student's general area of study or reflect their prior experiences (e.g., current or previous course work, professional experiences, graduate assistantship experiences, research interests). By attending to this point, especially at the beginning of the experience, mentors scaffold student success and efficiency by targeting their prior knowledge (Halpern & Hakel, 2003) and ensuring that they are comfortable with the jargon they will encounter during the task. A procedure for collecting these areas formally from each student is important. Further, these areas can be expanded as each student's knowledge and experience develops as they progress toward degree attainment such that manuscripts reflect their present level of expertise. When tailoring manuscript type and topic to students' prior experiences, as their expertise broadens, manuscript topic areas should likewise expand; thus, mentors gradually reduce the level of support (Chaiklin, 2003; Wood et al., 1976) such that students are eventually regarded as expert reviewers.

A PhD student in the social sciences, for example, will develop an understanding of research methodology

over a period of several years. Should a student be at the beginning of that process, it might be more appropriate to assign only theoretical, review, and instructional manuscripts. Then, as student confidence and knowledge expand, more advanced examples of empirical research can be assigned per their individual research foci (e.g., qualitative, quantitative, mixed methods) and interests. Eventually, the assumption would be that the students evaluate a variety of research manuscripts. In the end, these supports can be minimized as the mentor or editor sees fit, such that the student is considered an expert reviewer (Chaiklin, 2003; Wood et al., 1976). We suggest, however, that an open line of communication is present for students to communicate when they are uncomfortable offering an opinion on a manuscript, a point that segues to our next suggestion.

Peer Review Agreement

To ensure that a student is reviewing a manuscript s/he feels qualified to review, agreement to review each manuscript should be obtained in advance. Thus, students have the opportunity to assess their confidence and decline requests if they do not feel qualified to offer professional opinions. Further, this encourages perceptions of a safe learning environment while providing feedback to the individuals who assign manuscripts and act as mentor.

Providing Feedback

Rather than requiring students to immediately complete reviews that are formally submitted and disseminated to the authors, we suggest that the first one or two reviews be practice-oriented, time permitting. "Experience alone is a poor teacher" (Halpern & Hakel, 2003, p. 40) or, in this context, simply attempting to complete peer reviews is insufficient to improving writing skills without corrective and systematic feedback. Thus, the mentor should read the student's review and the manuscript (provided that the review process permits a third party access to the manuscript under review) in full to provide appropriate feedback. However, it is important to consider during this procedure that each reviewer offers a distinctive perspective. Thus, these meetings are not to assess whether or not the student considered the same points in a similar manner as the mentor, but that the student offered a unique perspective reasonable and appropriate to the task at hand. Example feedback might consider the following:

- professional phrasing (e.g., jargon, terminology, tone/manner),
- technical details of the review (e.g., length, organization, specificity),

- strong points made, and
- significant points overlooked (if any, and only if the mentor is permitted access to the manuscript).

In addition, we recommend mandatory meetings just prior to review submission during the initial reviews (e.g., five) and continued as needed. During these meetings, questions, expectations, and feedback should be discussed. The mentor might also use this time to ask students to justify their review decisions and the suggestions they offered in the reviews. Moreover, an open line of communication should be in place for needed guidance between meetings. Thus, some level of support is provided until students can serve in the role independently and efficaciously. We recommend that one or two reviews per month would be sufficient for the experience, and would not be too great a burden on the student or mentor.

External Supports

Many of the supports we have proposed thus far concern the review process with less attention given to further developing content knowledge; an intentional focus. Upper level graduate students should have a strong foundation in their fields of study and may even possess prior experience as professionals in their fields. Thus, content learning is less important when successfully navigating the reviewing process discussed here. For instructors to support transfer, content should be utilized in learning environments in which the information can be applied (Doyle, 2008), such as serving as a peer reviewer. Accordingly, greater attention is given to the scaffolds provided through interactions with faculty or journal editors and the information (e.g., guidelines, procedures, examples) provided in advance, such as:

- A description of the student's role and the double-blind review process (e.g., see Figure 1).
- A document describing the mission of the journal and submission guidelines (e.g., see International Journal of Teaching and Learning in Higher Education [IJTLHE], 2014a, 2014b).
- A clear rubric or explicit guidelines for the final review product (e.g., see Appendix; IJTLHE, 2014c).
- Several example or model reviews.

Providing scaffolds in this way will support students' learning and motivation for professional peer review by clearly communicating task objectives and outcome expectations (e.g., Bandura, 1986; Deci & Ryan, 2000, 2012; Schunk & Pajares, 2005). However, as noted

Figure 1
Example Flowchart of the Peer Review Process
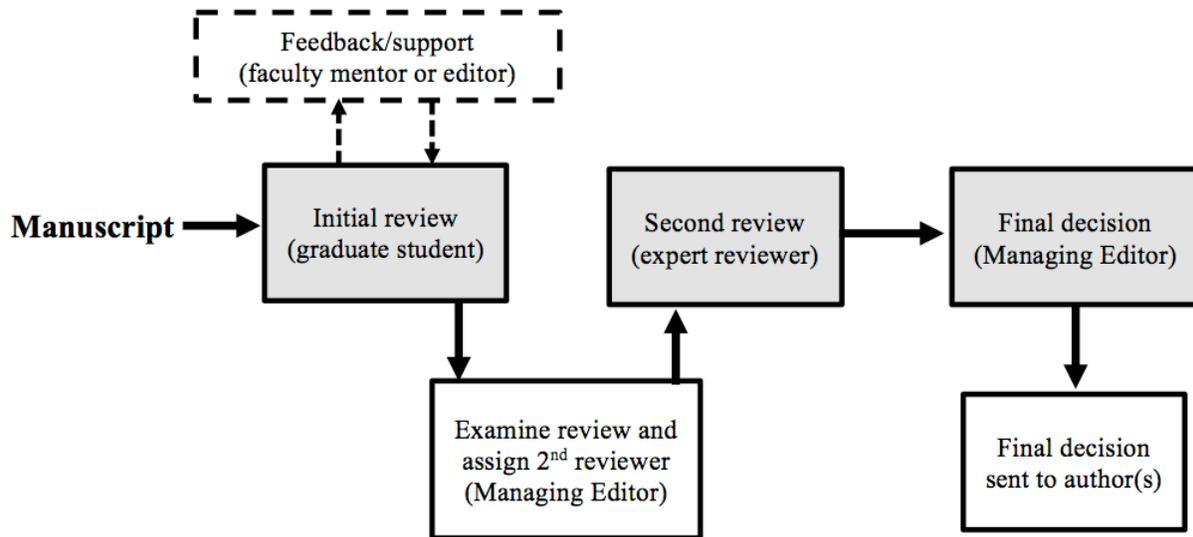
Note. A flowchart similar to this can be provided to the student so that s/he understands the process and his/her role as an initial reviewer.

above, it is important that these supports gradually diminish over time as students develop expertise, which will help to prevent overreliance on external support (Wood et al., 1976).

We have described the theoretical and empirical support for engaging students in the professional review process, as well as several suggestions for implementation. However, where and how this learning experience is implemented depends on the unique structure of each graduate program. Our experience engaging in the peer review process as graduate students was part of our graduate assistantship responsibilities. Thus, our access to a mid-tier journal and its editors was perhaps easier than it may be for some. However, we believe there are many environments in which this learning experience might also be successful and that each program or mentor might consider adapting the experience per their department's (or institution's) unique structure. For instance, some might consider implementing peer review as a graduate program requirement (e.g., as one or more course assignments either in one course or across multiple courses, as an activity considered part of the advisee/advisor relationship, as a graduate assistantship responsibility) and others might incorporate it as an optional (or volunteer) activity (e.g., as a field study or independent study focus, as a professional seminar task). It is worth noting that access to a peer-reviewed journal, in some fashion, is necessary to implement

this approach. Faculty and departments interested in implementing this learning experience might consider contacting colleagues who have ties with journal editors or contacting journal editors directly, and then collaborating to formalize procedures for including their graduate students in the peer review process. Many faculty members already engage in peer review as part of their professional service; thus, such ties to one or more refereed journals could serve as a starting point for opening lines of communication. Although collaboration with managing editors would be necessary, as they assign manuscripts for review, it is not required that they serve as the primary support for the student reviewer. Associate editors, other current reviewers, or faculty members could easily fulfill this role. In making this decision, it is important for implementers to consult the journal's guidelines on whether or not assigned reviewers may show the manuscript to a third party. It is possible that mentors may only be permitted to read the student's review (rather than also reading the manuscript under review). Thus, ethical considerations regarding anonymity during the blind review process are pertinent to the design and implementation of this learning experience.

In the end, we were unable to locate scholarly literature indicating that this practice is used elsewhere. Thus, involving graduate students in the professional peer review process is an area for future development, dialogue among scholars, and research.

Conclusion

Although engaging in the professional peer review process is a far cry from developing a manuscript worthy of publication, throughout the process students are evaluating content and formulating a timely response—an activity common to graduate education and professional activities in academe (e.g., formal reviews, grading, collaborative research, advising graduate students). Further, research suggests that student writing should improve through regular analysis of both "good" and "bad" examples of scholarly writing (Bruner et al., 1956; Doolittle, 2000), as well as engaging in the critical process of determining strengths and areas for improvement (Bloom et al., 1956; Halpern & Riggio, 2003). Whitehead (2002) went so far as to suggest that academic writing skills are "probably the most important component in demonstrating scholarship" (p. 499). We posit that involving graduate students in the professional peer review process will support students in developing a variety of essential skills, thus serving as a bridge toward gaining independence as scholars.

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Appendix
Manuscript Review Criteria[1]

Review criteria for three styles of manuscripts—research, instructional/theoretical, and review—are listed below. During the review procedures, the peer reviewer accesses these criteria through a password protected system and is asked to rate each of the numbered criteria on a 4-point scale: 1 (*excellent*), 2 (*good*), 3 (*fair*), 4 (*poor*), and 5 (*missing*). In addition, a half- to full-page formal written review is required. Then, the peer reviewer selects one of three options: (a) accept, with revisions; (b) not accept, encourage resubmission; and, (c) not accept.

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Research Articles:

Research articles include 15-25 page manuscripts (4,000-7,000 words) that are theoretical or empirical in nature. Research articles are to be well grounded in the relevant literature and present knowledge, methods, and insights relevant to higher education pedagogy. The broad scope of the journal and its diverse readership necessitates that research articles address issues that have a wide appeal and significance to higher education practitioners.

1. **Focus:** Is the research manuscript's focus in congruence with the stated mission and foci of the journal? Specifically, all research manuscripts should focus on the study, development, application, and evaluation of higher education pedagogy.
2. **Problem:** Does the research manuscript clearly state and explain the problem or issue that is addressed by the completed research? This statement of the problem should be directly linked with and in alignment with the subsequent review of the literature.
3. **Literature:** Does the research manuscript identify the research that led the manuscript author(s) to propose the research completed, and has/have the author(s) indicated how the current manuscript adds to the previous research?
4. **Methodology:** Is the methodology described in the research manuscript well developed, clearly articulated, and appropriate given the expressed problem, literature support, and research approach (e.g., qualitative or quantitative)?
5. **Analysis:** Are the data that are collected, regardless of form (e.g., interview transcripts, achievement test scores, survey results), analyzed using appropriate procedures and are the results of these analyses reported accurately and fully within the research manuscript?
6. **Conclusions:** Are the conclusions discussed by the author(s) in the research manuscript supported by the data analysis? In addition, does the conclusion address both the original problem and the implications of the research findings?
7. **Cross-disciplinary:** Does the manuscript, either through the nature of the problem or the discussion of the results, reach beyond a single discipline or domain and address the applicability of the problem and results to higher education pedagogy, in general?
8. **Organization:** Is the research manuscript organized in accordance with current accepted formats for reporting qualitative or quantitative research? In addition, all quantitative research manuscripts should follow the latest version of the APA guidelines.
9. **Writing:** Is the manuscript free from grammatical, punctuation, and spelling errors, and is the manuscript written in an appropriate style? Uncertain issues of format or style should be answered using the latest version of the APA style guidelines.
10. **Format:** Does the manuscript conform to the organization, style, and format guidelines set forth by the latest version of the *Publication Manual of the American Psychological Association*?

Instructional Articles:

Instructional articles are 5-15 page manuscripts (1,500-4,000 words) designed to explain and clarify innovative higher education teaching methods. Instructional articles, while grounded in the literature on higher education

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pedagogy, focus on the explanation of tentative, emerging, or alternative teaching methodologies, rather than the strict reporting of empirical data.

1. **Focus:** Is the instructional manuscript's focus in congruence with the stated mission and foci of the journal? Specifically, all instructional manuscripts should focus on the study, development, application, and evaluation of higher educational pedagogy.
2. **Problem:** Does the instructional manuscript clearly state and explain the problem or issue that is to be addressed by the instructional method discussed later in the article? This statement of the problem should be directly linked with and in alignment with the subsequent review of the literature.
3. **Literature:** Does the instructional manuscript identify prior methods used to address the instructional problem at hand and has the author(s) indicated how the current manuscript adds to the body of knowledge to address the problem?
4. **Pedagogy:** Is the pedagogy described in the instructional manuscript well developed, clearly articulated, and appropriate given the expressed problem and literature support? The pedagogy description should be clear enough that others who may wish to adopt the pedagogy may do so.
5. **Analysis:** Is it clear how the pedagogy described in the instructional manuscript addressed the instructional problem at hand?
6. **Conclusions:** Are the conclusions discussed by the author(s) in the instructional manuscript supported by the analysis? In particular, are the conclusions logically consistent and do they logically follow from the problem statement, the literature, the pedagogy, and the analysis?
7. **Cross-disciplinary:** Does the instructional manuscript, either through the nature of the problem or the discussion of the results, reach beyond a single discipline or domain and address the applicability of the pedagogy and results to higher education pedagogy, in general?
8. **Organization:** Is the instructional manuscript organized in accordance with currently accepted formats for reporting pedagogical methods? In particular, is there a logical flow to the ideas presented therein?
9. **Writing:** Is the instructional manuscript free from grammatical, punctuation, and spelling errors and is the manuscript written in an appropriate style? Uncertain issues of format or style should be answered using the latest version of the APA style guidelines.
10. **Format:** Does the instructional manuscript conform to the organization, style, and format guidelines set forth by the latest version of the *Publication Manual of the American Psychological Association*?

Review Articles:

Review articles are 3-5 page manuscripts (1,000-1,500 words) that include commentaries and evaluations of recently published works—books, articles, or web sites—related to higher education pedagogy.

1. **Focus:** Is the manuscript and the material reviewed (e.g., books, articles, web pages) in congruence with the stated mission and foci of the journal? Specifically, all review manuscript and materials reviewed should focus on the study, development, application, and evaluation of higher education pedagogy.
2. **Problem:** Does the review manuscript clearly state and explain the problem or issue that is addressed by the reviewed material? This statement of the problem should be directly linked with and in alignment with the subsequent discussions of the reviewed material's contents and evaluation.
3. **Contents:** Does the review article adequately describe and explain the contents of the reviewed materials? The descriptions and explanations should include both what is addressed and what is missing.
4. **Evaluation:** Is the material reviewed evaluated with special attention given to the material's significance and applicability to higher education pedagogy? In addition, does the evaluation link the currently reviewed material to existing, but similar, materials?
5. **Conclusions:** Are the conclusions discussed by the author(s), in the review manuscript, supported by the discussions of the content and subsequent evaluations?
6. **Cross-disciplinary:** Does the manuscript, either through the nature of the problem or the discussion of the results, reach beyond a single discipline or domain and address the applicability of the problem and results to higher education pedagogy, in general?
7. **Organization:** Is the review manuscript organized in a logical and readable format?
8. **Writing:** Is the manuscript free from grammatical, punctuation, and spelling errors, and is the manuscript written in an appropriate style? Uncertain issues of format or style should be answered using the latest version of the APA style guidelines.
9. **Format:** Does the manuscript conform to the organization, style, and format guidelines set forth by the latest version of the *Publication Manual of the American Psychological Association*?

Complex Constructivism: A Theoretical Model of Complexity and Cognition

Peter E. Doolittle
Virginia Tech

Education has long been driven by its metaphors for teaching and learning. These metaphors have influenced both educational research and educational practice. Complexity and constructivism are two theories that provide functional and robust metaphors. Complexity provides a metaphor for the structure of myriad phenomena, while constructivism provides a metaphor for learning. In the synthesis of these two powerful metaphors lies a new metaphor—complex constructivism. The reality of complex constructivism is one in which the non-linear, adaptive, and constructive nature of learning is embraced. Complex constructivism views learning as the active construction and adaptation of one's internal models of reality based on the interaction between oneself and one's environment (including other persons), such that the functioning of one's internal models exceeds the sum of the models' components.

Education has long been driven by its metaphors for teaching and learning. These metaphors have influenced both educational research and educational practice (Leary, 1990). Since the late 1800s, three metaphors have dominated education: (a) learning as the acquisition of stimulus-response pairs (behaviorism), (b) learning as the processing of information (information processing), and (c) learning as the construction of knowledge (constructivism). Currently, there is an opportunity within education to examine the essentials of a new metaphor: learning as self-organized adaptation based in complexity theory (Brown, 2008).

These changes in explanatory metaphors have resulted from, and have allowed for, new insights concerning the nature of learning and knowledge. As researchers began to see that complex learning was difficult to explain using complicated chains of Stimulus $\rightarrow$ Response (S $\rightarrow$ R) pairs, and as the computer began to enter the academic consciousness, information processing theory emerged to explain how mental structures affect behavior. Then, after decades of productive research—that continues today—into the components of memory and cognition, it became apparent that context and culture influenced the representation of these components, and constructivism emerged to explain personal and cultural knowledge, meaning, and reality. However, as these new metaphors have emerged, one perspective has remained constant, the idea that learning involves parts, wholes, and adaptation. For behaviorism and information processing, the part-whole relationship is such that the whole can be predicted from the understanding of its parts. For the behaviorists, the component parts are S $\rightarrow$ R pairs, while for information processing theorists the component parts are memory structures. For constructivists, the component parts are experiences; however, constructivists recognize that the global behavior of an individual is not directly predictable through the understanding of an individual's experiences (Hacking, 1999; Tobias & Duffy, 2009).

In complexity theory—as in behaviorism, information processing, and constructivism—component parts are important. However, in complexity theory, what constitutes a "part," or an *agent*, depends on the level from which one views the learning process. An agent could be a neuron, a neuronal group, an experience, an individual, or a group of individuals. What is of importance, regarding agents, are not the agents themselves, but rather, the interaction of these agents with each other (Holland, 1995). As with constructivism, a complexity perspective recognizes the difficulty in predicting global behavior from an understanding of the parts (Guanglu, 2012; Waldrop, 1992). This complexity-based alternative perspective to understanding the whole, by understanding its parts, is to understand the whole by understanding the *interaction* of its parts (Cilliers, 2010; Lewin, 1992).

What follows is designed to (a) introduce the essential elements of a complexity-based view of learning, (b) demonstrate that the current emphasis in education on constructivism is compatible with a new perspective on education using complexity theory, and (c) discuss how complexity theory may expand our view of the learning process. These aims will be addressed through the presentation of a generic constructivist model, a generic complexity model, the development of a hybrid complex-constructivist model, and a discussion of the usefulness of a complex-constructivist view of learning.

Constructivism

Constructivism is generally the approach that learners construct their own knowledge from interpreting their experiences. Fosnot (1996) provided a more eloquent and inclusive definition:

Learning from this perspective is viewed as a self-regulatory process of struggling with the conflict between existing personal models of the world and discrepant new insights, constructing new representations and models of reality as a human meaning-making venture with culturally developed tools and symbols, and further negotiating such meaning through cooperative social activity, discourse, and debate. (p. ix)

It is this combination of learner autonomy and holistic perspective that has thrust constructivism to the forefront of learning science and education. Learner autonomy is the concept that learners are active participants in the learning process and ultimately responsible for their own learning. This holistic perspective is a non-reductionist approach that emphasizes learning in context.

The integration of learner autonomy and holistic perspective places constructivism at the nexus of psychology and philosophy. A foundational issue in this psychological and philosophical nexus is the role of epistemology; that is, what is the nature of knowledge and how does the knower come to know (Doolittle & Hicks, 2003; Ernst, 1995). From this perch, von Glasersfeld (1984, 1995, 1996) and Doolittle and Hicks (2003) cited the pillars of constructivist epistemology as:

- Knowledge construction is an individually and socially active process.
- This active process of constructing knowledge is adaptive in that the end result is to make one's thoughts and behaviors more effective relative to achieving one's goals.
- Understanding of one's experience is a function of individual and social interpretation of one's experience.

These pillars, while illuminating, allow for great variability in what is typically called "constructivism" (Phillips, 1995; Prawat, 1996). Moshman (1982) helped to define this variability through a continuum of constructivism. Moshman (1982) defined the poles of

this continuum as *exogenous constructivism*, *dialectical constructivism*, and *endogenous constructivism*, what would more typically be called today *trivial constructivism*, *social constructivism*, and *radical constructivism*. This constructivist continuum provides a rationale for the placement of other types of constructivism (see Figure 1).

Constructivist Models

Trivial constructivism emphasizes the external nature of knowledge (see Figure 2). Knowledge is seen as the internalization and reconstruction of external reality. Learning or knowledge acquisition is the process of building accurate internal models or representations of external structures in the "real" world. This view presupposes that reality is knowable. Trivial constructivism is often erroneously associated with information processing and its component processes, including schemata, declarative and procedural knowledge, and propositional-networks (Derry, 1996). Trivial constructivism often serves the role of "straw man" against which constructivism, writ large, is compared.

In Figure 2, the dark rectangle on the left represents some aspect of knowable reality that is to be constructed by the student. This knowledge is subdivided into discrete sub-skills by the teacher who then transmits this knowledge to the student. A successful teaching/learning event results when the student, after this transmission experience, has constructed an accurate representation (the dark rectangle on the right) of the original, knowable knowledge.

Trivial constructivism represents one extreme of the constructivist continuum, while radical constructivism represents the other extreme. Radical constructivism emphasizes the internal nature of knowledge (see Figure 3) and is based on the theoretical foundation of Piaget (1973, 1977). Knowledge is constructed from both external experiences and earlier mental structures. Learning or knowledge acquisition is the reconstruction and reorganization of old knowledge structures in light of new experiences. Thus, knowledge is not an accurate

Figure 1
A Constructivist Continuum

Trivial Constructivism	Social Constructivism	Radical Constructivism
Exogenous Constructivism	Dialectical Constructivism	Endogenous Constructivism
Cognitive Constructivism	Social Constructionism	Schema-based Constructivism
Information Processing Constructivism	Sociocultural Constructivism	Emancipatory Constructivism
Psychological Constructivism	Symbolic Interactionist Constructivism	Developmental Constructivism
Naïve Constructivism	Idea-based Social Constructivism	Psychological Constructivism

Figure 2
Cognitive Constructivism

Teacher   Student

original   discrete   learn   combine sub-skills   student's copy
objective   sub-skills   sub-skills   of objective
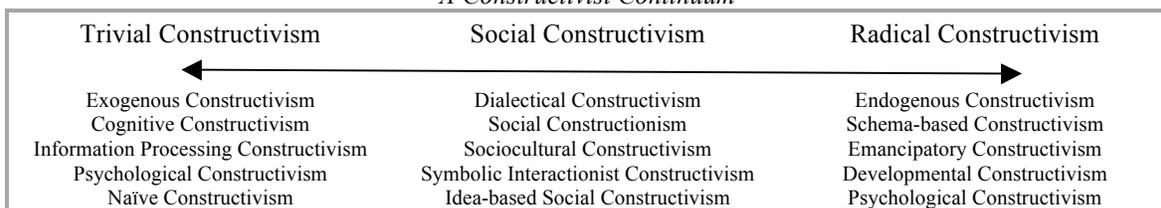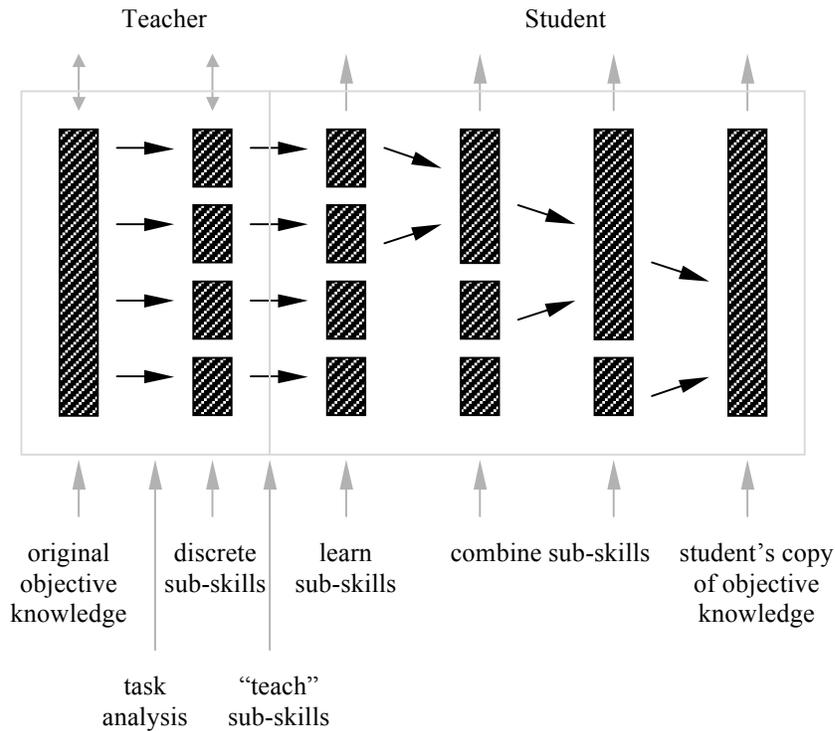knowledge   knowledge

task   "teach"
analysis   sub-skills

representation of external reality, but rather is an internally coherent and coordinated collection of processes and structures that provide for adaptive behavior. This view presupposes that reality is not knowable (von Glasersfeld, 1995).

According to Piaget (1973), cognitive development is the result of invariant changes in internal mental structures, characterized by a continuum of qualitatively different reasoning skills, and caused by integrating and extending previous levels of cognitive development into new knowledge/cognitive levels. Piaget emphasized the role of discovery and exploration as activities or experiences that fostered these changes in mental structure.

In Figure 3, derived from both Piaget (1970, 1973, 1977) and von Glasersfeld (1995), an individual experiences an event and seeks to understand that event through in terms of what they already know (assimilation) and what they have already experiences (re-presentation). This initial understanding leads to a goal directed response, either cognitive or behavioral. If the response is satisfactory then the initial understanding is reinforced, but if the response does not yield satisfactory results then the individual must reorganize or modify their initial understanding to better account for the unsatisfactory results. This process of event interpretation → cognitive/behavioral

action → expected/unexpected results → verifying/reorganizing understanding constitutes an adaptive process designed to make one's understandings and subsequent actions more viable.

Finally, social constructivism lies somewhere between the transmission of knowable reality of the trivial constructivists, and the interpretation of personally viable reality of the radical constructivists. Social constructivism emphasizes the interactional nature of knowledge (see Figure 4). Knowledge is the result of the *interaction* between the learner and the environment, including other learners. Learning or knowledge acquisition is the process of building internal models or representations of external structures as filtered through and influenced by one's beliefs, culture, prior experiences, and language, based on interactions with others, direct instruction, and modeling. This view presupposes that "reality" is not knowable.

According to Vygotsky (1978), cognitive development is based on a student's ability to learn socially relevant tools (e.g., hammers, pencils, computers) and culturally based signs (e.g., language, writing, number systems) through interactions with other students and adults who socialize them into their culture. These culturally mediated activities provide social experiences that are internalized and which later
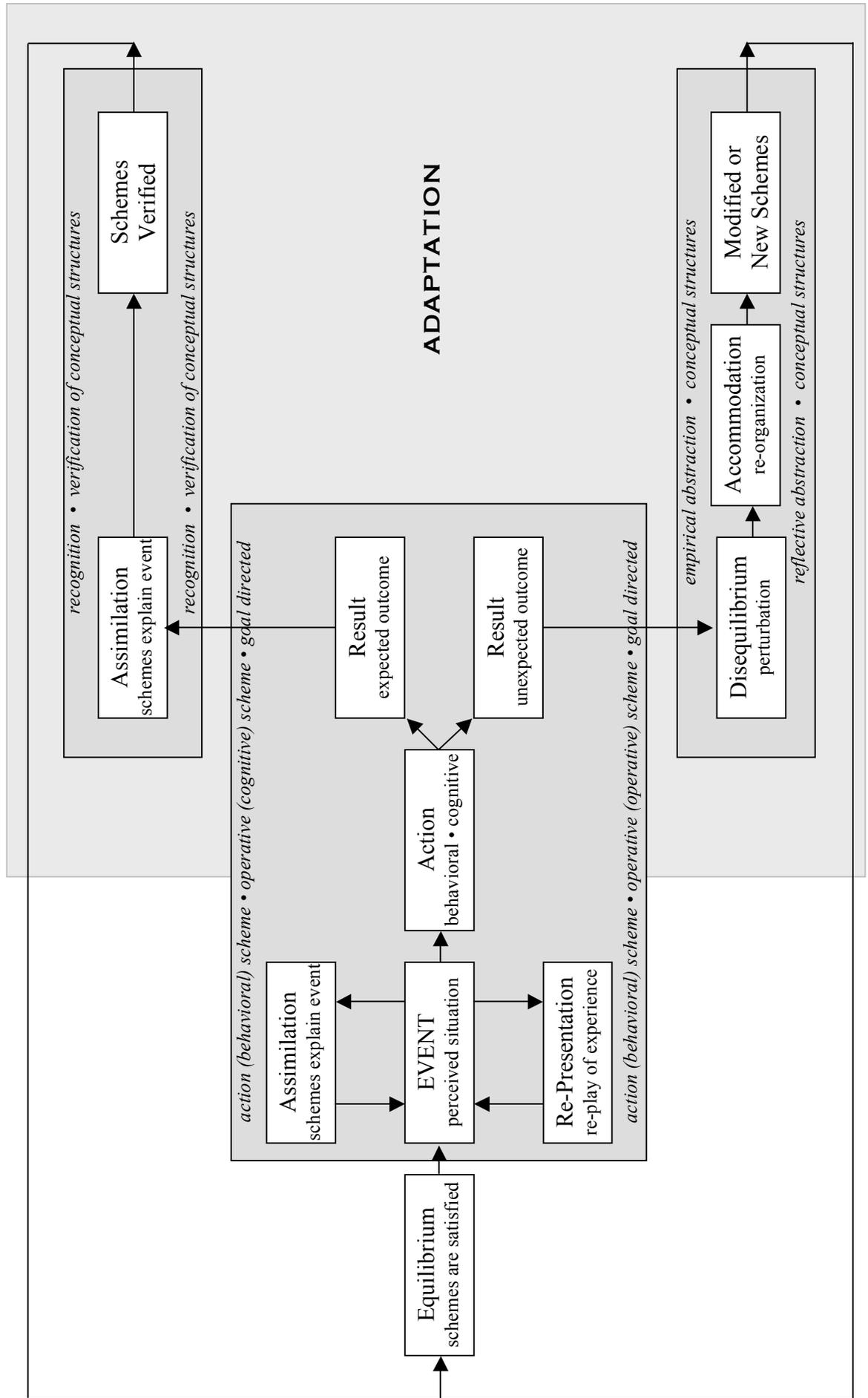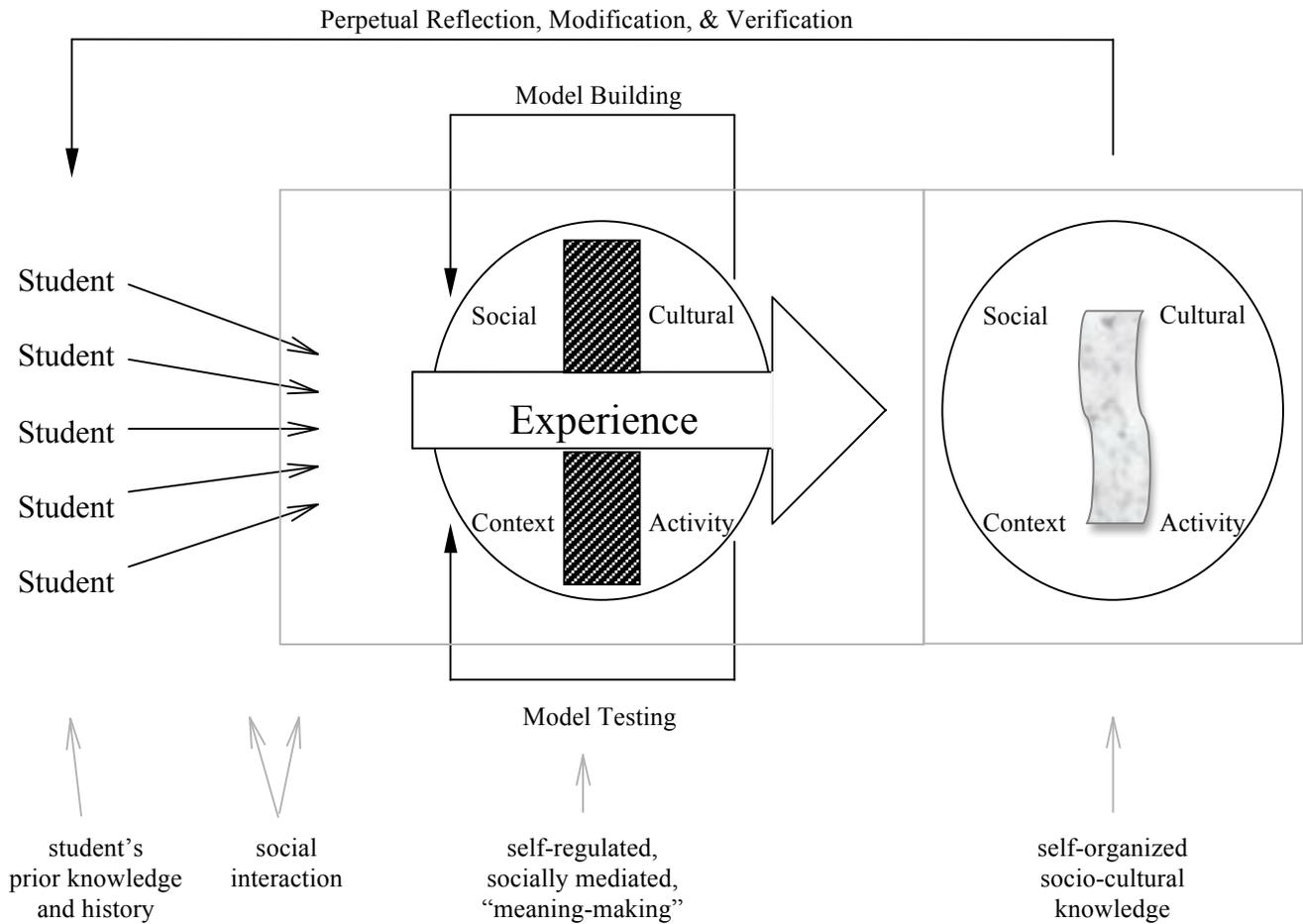
Figure 3
Radical Constructivism

Figure 4
Social Constructivism

Perpetual Reflection, Modification, & Verification

Model Building

Student

Student

Student

Student

Student

Social   Cultural

Experience

Context   Activity

Social   Cultural

Context   Activity

Model Testing

student's
prior knowledge
and history

social
interaction

self-regulated,
socially mediated,
"meaning-making"

self-organized
socio-cultural
knowledge

become a part of the individual's mental functioning. Thus, knowledge is the result of social experience, influenced by one's socio-cultural history, and resulting in a modified representation of experience.

In Figure 4, students interact with knowledge (dark rectangle) within a socio-cultural environment. This external social experience results in the formation of internal mental structures (models) that are influenced by the presence of social, cultural, contextual, and activity-based factors. The student does not acquire an exact representation of this knowledge (light rectangle), but rather, a personal interpretation of the external knowledge. The viability of this newly constructed knowledge will be based on the student's prior knowledge and the impact of the social, cultural, contextual, and activity-based factors.

Constructivist Learning Principles

Constructivism is a broad theory that lends itself to many interpretations. Under the guise of

constructivism lay many theories of learning, including situated cognition, anchored instruction, cooperative learning, inquiry and problem-based learning, generative learning, exploratory learning, reciprocal teaching, cognitive apprenticeships, and information processing. Yet, from these constructivist theories and the constructivist models (Figures 2-4), Doolittle and Hicks (2003) have derived the following principles of learning:

1. The construction of knowledge and the making of meaning are individually and social active processes.
2. The construction of knowledge involves social mediation within cultural contexts.
3. The construction of knowledge is fostered by authentic and real-world environments.
4. The construction of knowledge takes place within the framework of the learner's prior knowledge and experience.

5. The construction of knowledge is integrated more deeply by engaging in multiple perspective and representations of content, skills, and social realms.
6. The construction of knowledge is fostered by students becoming self-regulated, self-mediated, and self-aware.

These principles encompass the essence of constructivism, that is, learning as the adaptive and self-organized construction of knowledge that is a function of both one's prior knowledge and experience, and one's current socio-cultural activity. This perspective on learning reflects the complexity of learning as involving adaptation, self-organization, interaction, and history.

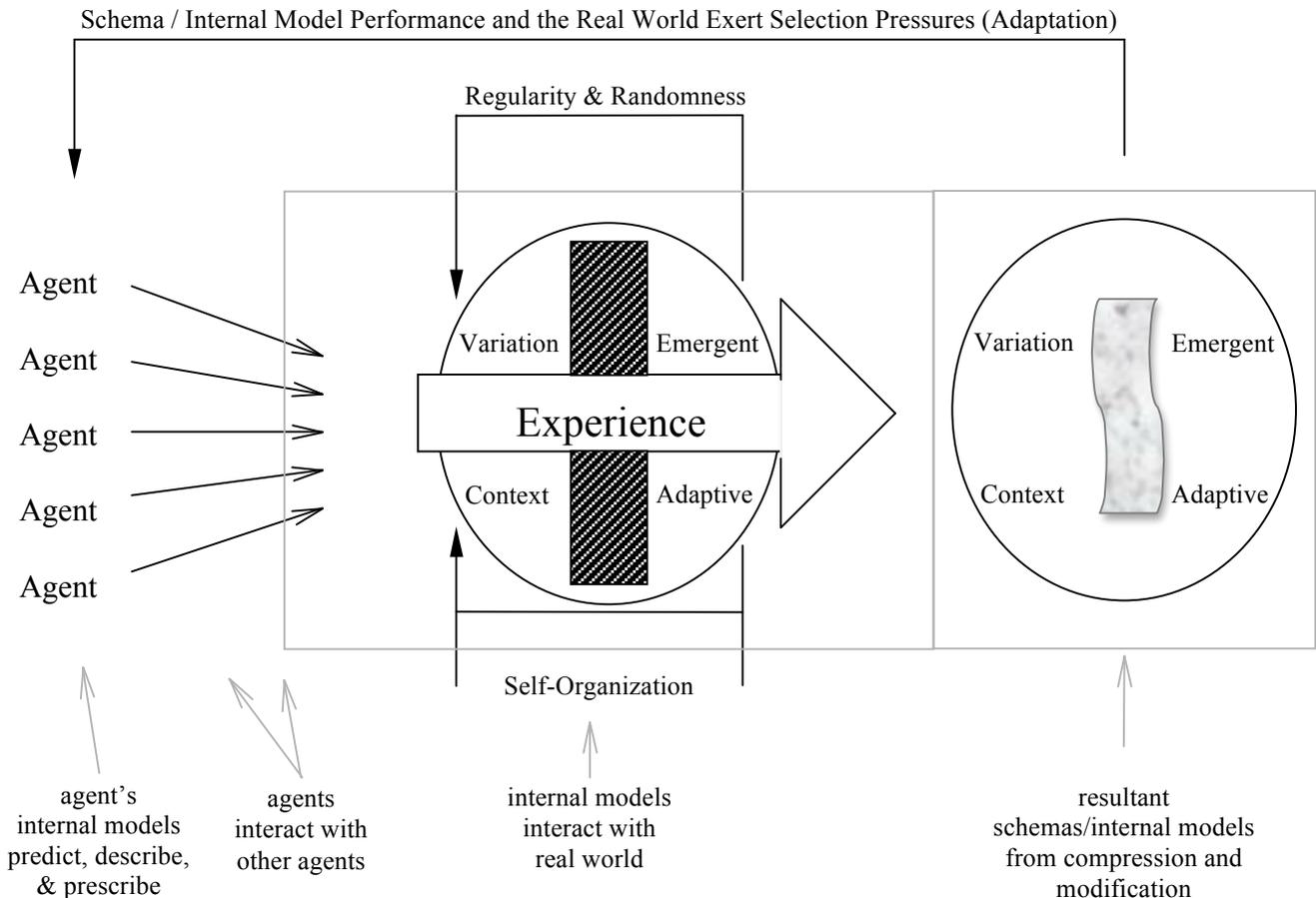**Complexity Theory and Complex Adaptive Systems**

The theory of complexity is not a theory of learning, memory, and cognition, per se; complexity is a broad-based theory concerning the evolution and functioning of non-linear systems that may be applied in many domains (e.g., evolution, immunology, economics), including learning, memory, and cognition (Coveney & Highfield, 1995; Hase & Kenyon, 2013; Morowitz & Singer, 1995). That said, new concepts and a new vocabulary are necessary to understand the essential aspects of a complexity perspective. A list of basic complexity theory terms includes adaptation, agents, complexity or complex adaptive systems, emergence, fitness, hierarchy, internal models, non-linearity, regularity and randomness, schemas, selection and selection pressures, self-organization, systems, and system dynamics. These terms and complexity theory, in general, are addressed using a school as an example of a complex system and Figure 5 as a conceptual model.

Complex Systems

The study of complexity involves the study of complex systems that are inherently non-linear, open, and far from equilibrium (Thelen & Smith, 1994). A *non-linear system* is unpredictable, that is, if one is familiar with all the components of the system, one is

Figure 5
Complexity Model

Schema / Internal Model Performance and the Real World Exert Selection Pressures (Adaptation)

Regularity & Randomness

Agent

Agent

Agent

Agent

Agent

Variation   Emergent

Experience

Context   Adaptive

Variation   Emergent

Context   Adaptive

Self-Organization

agent's internal models predict, describe, & prescribe

agents interact with other agents

internal models interact with real world

resultant schemas/internal models from compression and modification

still unable to determine exactly what will happen next (e.g., weather, human behavior, ecology). In addition, in a non-linear system the whole is greater than the sum (or average) of its parts (Holland, 1995). While complex systems are unpredictable and non-linear, they are also open. An *open-system* is a system that needs and receives energy to maintain its order. This maintenance of order places the system in a state that is *far from equilibrium*, equilibrium being the degenerative state that the system would inhabit if there were no influx of energy. Thus, a complex system is greater than the sum of its parts but requires energy to maintain this greater order. According to Kelso (1995),

> These are called open, nonequilibrium systems: open in the sense that they can interact with their environment, exchanging energy, matter or information with their surrounds; and nonequilibrium, in the sense that without such sources they cannot maintain their structure or function. (p. 4)

For example, a school is a non-linear, open, and far from equilibrium system (Larsson & Dahlin, 2012). The school is non-linear because even if one was to know the position and direction of movement of all the students, teachers, staff, and administrators at a given point in time, one would not be able to predict what would happen next. Students that were walking to the library may decide to go to their lockers instead and a teacher may suddenly decide to give a pop-quiz. Also, the activity in the school is far greater than the sum of the individual students, teachers, and administrators. As students, teachers, staff, and administrators begin to collaborate, the whole becomes greater than its parts. Student and teacher teams emerge, interacting students learn more than they were capable of learning on their own, and special programs are formed to assist students with their special needs. All of this far from equilibrium activity and learning is made possible through an influx of energy into the school (an open-system), energy in the form of students, materials, food, and money. If there were not this influx of energy, or resources, the school would deteriorate into a state of disrepair and disorder.

A non-linear, open, and far from equilibrium *system* is a group of interdependent elements, or agents, that interact to form a composite whole, while *system dynamics* refers to the feedback structures, methods, and outcomes of these interactions (Brodnick & Krafft, 1997). A complex system is composed of *agents*, individual active elements of a system that possess an internal state comprised of internal models, rules, and strategies that influence and guide the agent's behavior (Holland, 1995). A group of common agents is an *agent type*.
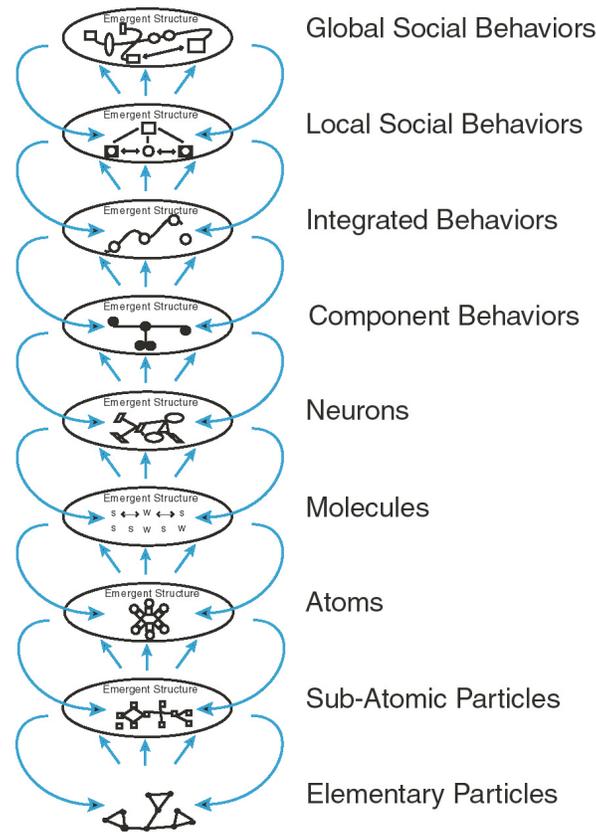
For instance, a school is a system that is comprised of several agents and agent types, such as students (a student is an agent, all of the students would constitute an agent type), teachers, staff, and administrators. The system dynamics involving the interaction of the students, teachers, staff, and administrators, is governed by explicit and implicit rules of conduct, order, need, and expectation.

In addition, each agent functions through the use of *internal models* or *schemas* (Gell-Mann, 1995; Holland, 1995). An internal model, or schema, is created or modified as the agent gains experience. As the agent gains experience, the agent abstracts the *regularity* from the *randomness* within the experience and begins to form internal models that describe these regularities. The agent may construct several internal models or schemas of a given experience, each internal model or schema providing a potential explanation of the experience. The process of changing recognized patterns of regularity into internal models occurs through *compression*. Compression results in abstractions or generalizations of experience, not a verbatim record. Often, internal models or schemas are described by a set of rules (see Holland, 1995, 1998). These internal models are then used by the agents to describe current events or behaviors, predict future events or behaviors, and prescribe subsequence behavior.

Continuing the school example, each student, teacher, staff, and administrator has several internal models or schemas related to the school environment. A particular student, for example, will have internal models or schemas that relate to how she interacts with teachers, takes tests, or fits into the school social structure. This student, while having different internal models or schemas related to different topics, may also have more than one internal model or schema for the same topic. She may have several internal models or schemas of how to interact with teachers, such as a friend, as a subordinate, or as a mentor. This student will continually create and modify her internal models and schemas based on her continuing interaction with teachers. She may notice that the female teachers like to be referred to as "Ms." and not "Mrs.", and so she modifies her internal model or schema accordingly. This generalization, or compression, of addressing the female teachers as "Ms." will allow the student to anticipate the need to use the "Ms." title (prediction and prescription), and will provide a basis for understanding when a teacher is curt with her after she uses the title "Mrs." accidentally (description).

In a complex system, these interacting agents exist within a hierarchy of agents (see Figure 6; Lewin, 1992). Agents at one level of the hierarchy interact with each other, and other agent types, and through this interaction an emergent global structure (Lewin, 1992),

Figure 6
An Agent Hierarchy

Global Social Behaviors

Local Social Behaviors

Integrated Behaviors

Component Behaviors

Neurons

Molecules

Atoms

Sub-Atomic Particles

Elementary Particles

or aggregate system of meta-agents or behavior, emerges (Holland, 1995). A meta-agent is an assembly of lower agents— "lower" and "higher" do not translate into "worse" and "better" or "less complex" and "more complex," lower and higher are used solely to represent differing levels and order of construction—that form a new agent at a higher level in the hierarchy (i.e., cells assemble to form organs, organs assemble to form organisms), while an aggregate behavior would be a behavior that is comprised of other more fundamental behaviors (e.g., playing basketball is comprised of walking, running, dribbling). These emergent global structures and meta-agents, upon forming, then feedback to the lower level agents to influence the lower level agents' interactions. An essential aspect of this process of lower level agents giving rise to higher level agents is that the nature and formation of the higher level agents is not predictable from an understanding of the individual behaviors of the lower level agents, a process known as *emergence* (Casti, 1994; Crutchfield, 1994; Holland, 1998). Emergence is an enigmatic process whereby fundamental agents produce surprising and unpredictable meta-agents or

behaviors. These meta-agents or behaviors are said to emerge from the interaction and collective properties of the lower agents (e.g., clouds emerge from water vapor and heat, life emerges from DNA, mind emerges from neurons). According to Thelen and Smith (1994), "These emergent organizations are totally different from the elements that constitute the system, and the patterns cannot be predicted solely from the characteristics of the individual elements" (p. 54).

Within a school setting, the students, teachers, staff, and administrators give rise to a particular school behavior or setting, that is, the specific nature, atmosphere, and environment of the school. The presence and interaction of these students, teachers, staff, and administrators (i.e., agents) leads to the emergence of surprising and unpredictable school behaviors, such as racial tension, academic rigor, or drug acceptance or rejection. Emergence, in the case of academic rigor, may involve a school in which students consistently put forth effort, teachers continually challenge their students, and administrators actively support both the teachers and students. This academic rigor is not a function of any one student, teacher, staff,

or administrator, but rather, this academic rigor is a function of the interaction between the students, teachers, staff, and administrators.

This process of emergence is deeply intertwined with the concept of self-organization. *Self-organization* refers to the spontaneous self-generation of order from within an open-system of agents (Capra, 1996; Kelso, 1995), or what Kauffman (1995) called "order for free." A fundamental component of self-organization is that order arises from within the interactions of the agents and is not imposed on the agents from some external force. Thus, as agents interact, they organize themselves according to local parameters and self-interest, and from this self-organization a more global or higher structure emerges. In this way, self-organization and emergence are inexorably linked. According to Jacobson (1997), "Self-organizing phenomena are inherently decentralized due to the local interactions of many individual agents, with order 'emerging' without centralized control structures" (p. 3).

Self-organization within the school example concerning academic rigor, might involve students meeting in study groups, teachers preparing academically challenging projects, and administrators purchasing extra equipment for students and teachers. These activities have not been organized outside of the school and imposed on the students, teachers, staff, and administrators; rather, the students, teachers, staff, and administrators have developed these activities themselves, to satisfy their own (agent-based) goals and needs. In addition, it is these self-organized activities that have led to the emergence of the academic rigor, and in turn, this academic rigor has influenced the further self-organization of activities, forming a feedback mechanism.

This process of self-organization ➔ emergence ➔ feedback forms the basis for selection pressure and adaptation (Gell-Mann, 1994). As agents interact with other agents and the environment, the agent's internal models and schemas self-organize and emerge. In this process, the agent's interactions with other agents and the environment serve as evaluations of the agent's internal models and schemas. If an agent repeatedly exhibits a behavior that is counter-productive, based on an internal model or schema, then the internal model or schema is modified, discarded, or ignored. If, however, the agent repeatedly exhibits a behavior that is productive, then the internal model or schema that is responsible is retained. Gell-Mann (1994) referred to this evaluative feedback, from instantiating internal models or schemas in the real world, as *selection pressure*; that is, the real world exerts pressure on the agent to select the internal model or schema that consistently produces favorable results. In a similar manner, from a Darwinian natural selection perspective,

those agents that are able to generate and select effective internal models and schemas will be more likely to be selected for reproduction and survival. In addition, an agent that is capable of repeatedly selecting internal models and schemas that are favorable is considered *fit*, or to have *fitness*, in relation to the environment in which the agent exists. However, environments do not remain static, thus an agent's level of fitness is always in a state of flux. This state of flux requires the agent to continually monitor and modify its internal models and schemas as the environment changes, a process known as adaptation (Kauffman, 1993, 1995). *Adaptation* refers to changes in internal models or schemas that improve the performance (or fit) of the agent, whether that performance is reproduction, survival, money, or knowledge. Holland (1995), in defining adaptation in complex systems, stated, "Roughly, experience guides changes in the organism's structure so that as time passes the organism makes better use of its environment for its own ends. Here we expand the term's range to include learning and related processes" (p. 9).

Maintaining the school and academic rigor example, selection pressures for student performance might involve grades, college admission, parental approval, and peer approval. As a student uses various study strategies, and succeeds or fails, and as this student watches other students use various study strategies, and they succeed or fail, the student constructs internal models and schemas related to study strategies and which work and which do not work, under various conditions. Indeed, this student may experience both success and failure using the same study strategy for two different teachers, reflecting two different levels of fitness for the same strategy. At this point, the student needs to adapt to the environment by using the appropriate study strategy with the appropriate teacher. Thus, retaining internal models or schemas that are fit and modifying internal models or schemas that are less fit leads to adaptation and better overall performance.

In summary, complex systems are non-linear, open, and far from equilibrium systems that are comprised of interdependent agents whose interactions, based on internal models and schemas, lead to self-organized and emergent behaviors that have dynamic fitness levels in response to selection pressures exerted by changing environmental conditions, thus facilitating the need for adaptation in order to maintain effective performance.

Complexity Principles

This broad-based theory has been developed as an inter-disciplinary theory, crossing any and all domain boundaries. Given this inter-disciplinary nature, the search for basic principles that underlie all complex

systems is a major focus of complex systems research. The following principles are derived from this research (Beabout, 2012):

1. Complex systems are non-linear, open, and far from equilibrium.
2. Complex system behavior involves adaptation to the environment, based on experience.
3. Complex system behavior is a function of internal models or schemas that are the result of perceived regularities in experience.
4. Emergent global complex system behavior involves the aggregate behavior of agents
5. Internal models and schemas are actively constructed, self-organized, and emergent.
6. Internal models and schemas are a function of both agent interaction and existing internal models and schemas.

Each of these principles has been discussed and exemplified in the preceding section. As general tenets of complexity, these principles may be applied to a wide array of complex systems. One such system involves human learning. Each of these principles may be applied to the process of learning, in general, and the theory of constructivism, specifically.

Complex Constructivism

Complexity and constructivism are two theories that provide functional and robust metaphors. Complexity provides a metaphor for myriad phenomena, while constructivism provides a metaphor for learning. In the synthesis of these two powerful metaphors lies a new metaphor - complex constructivism. According to Lakoff and Johnson (1995), "New metaphors have the power to create a new reality" (p. 145).

The reality of complex constructivism is one in which the non-linear, adaptive, and constructive nature of learning is embraced. Complex constructivism views learning as the active construction and adaptation of one's internal models of reality based on the interaction between oneself and one's environment (including other persons), such that the functioning of one's internal models exceeds the sum of the models' components. This definition leads to six general principles of learning based on complex-constructivist ideals:

- learning involves an individual's adaptation to the environment;
- learning involves the active construction of knowledge by the individual;
- learning involves the self-organization of knowledge and experience into internal models;
- learning involves the emergence of internal models as a natural consequence of an individual's on-going experience;
- learning is a function of both individual interaction and existing internal models; and
- learning occurs within agent hierarchies and selection pressures that includes individuals, family, friends, and local and global culture.
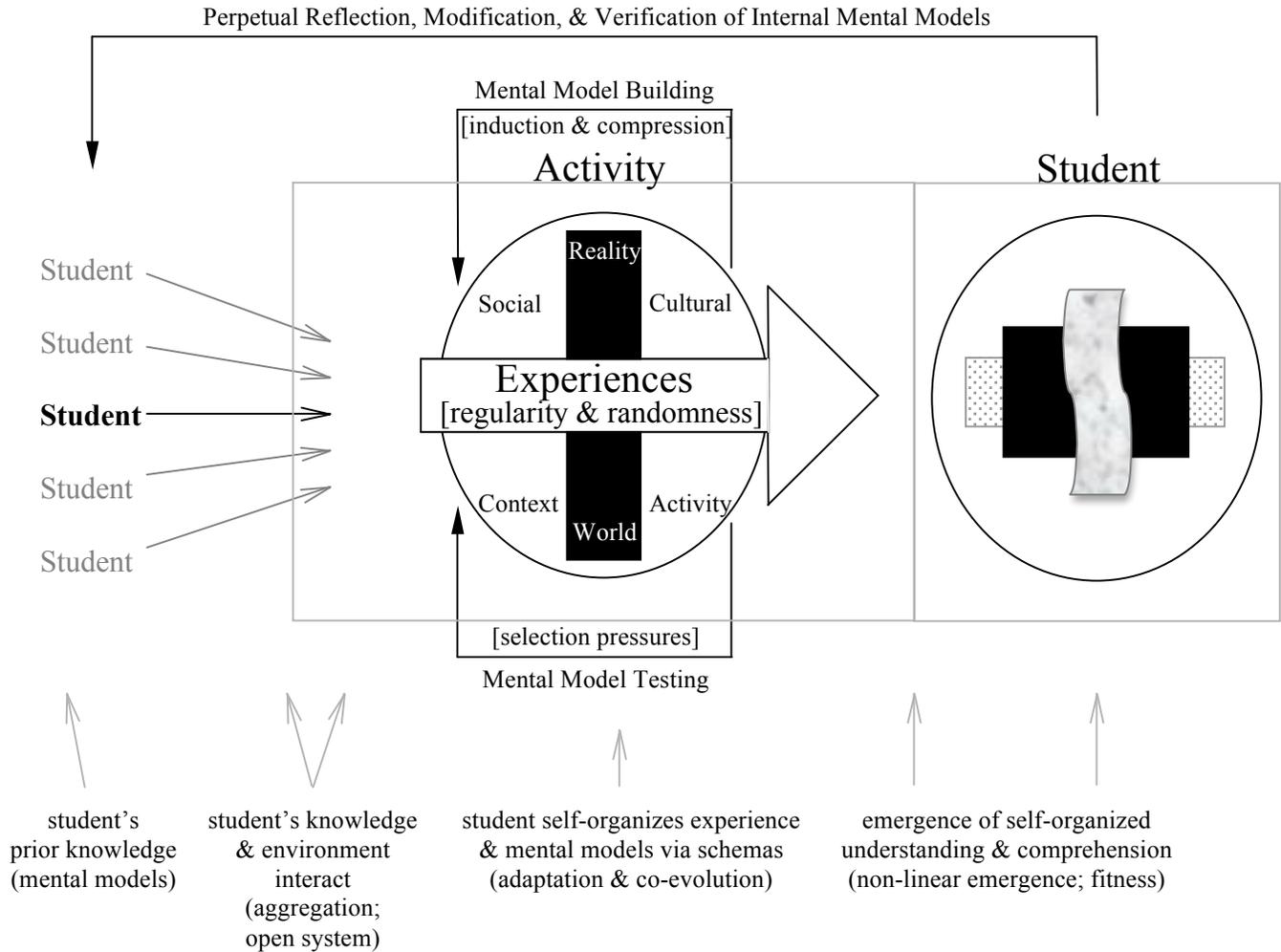
These general principles emerge from the synthesis of complexity theory and constructivist theory to provide links to a new perspective on learning, memory and cognition. These principles also provide a foundation upon which to build new ideas relating complexity and constructivism. Figure 7 is a graphical model of the relationship between these principles, based on the earlier models of constructivism (Figure 4) and complexity theory (Figure 5).

The complex-constructivist model in Figure 7 represents the self-organized and adaptive nature of learning. Students enter an experience with existing internal (mental) models, or schemas, that allow the student to predict how the experience may transpire, to prescribe desired behaviors based on the predictions, and to describe the experience as it occurs. However, students with limited existing internal models related to the current experience will have only a limited ability to predict, prescribe, and describe, while students with more well developed internal models will be able to predict, prescribe, and describe more effectively.

These students' internal models are affected by not only the experience, but also interactions with other students and their internal models. As the students are engaged in the experience, and potentially interacting with other students, the students are determining which aspects of the experience are familiar, and which aspects of the experience are novel. The recognition of familiar experiences indicates the existence of internal models relative to the experience, while a lack of familiarity indicates the non-existence of a related internal model. An existing internal model represents the student's prior identification and compression of regularities within this type of experience.

The process of recognizing and compressing regularities is paramount to students constructing internal models. Regularity is knowledge. As students encounter experiences, they begin to actively look for regularities and compress these regularities into an abbreviated form (schemas), that is, the students begin to actively construct knowledge from within the vast array of stimuli in the experience, based on existing internal models. This process of active regularity extraction, or active knowledge construction, is fundamental to making meaning from the experience. The student's make an experience meaningful by relating the experience to the regularities existing

Figure 7
Complex Constructivism

Perpetual Reflection, Modification, & Verification of Internal Mental Models

Mental Model Building
[induction & compression]

Activity   Student

Student

Student

Student

Student

Student

Reality
Social   Cultural
Experiences
[regularity & randomness]
Context   Activity
World

[selection pressures]
Mental Model Testing

| student's prior knowledge (mental models) | student's knowledge & environment interact (aggregation; open system) | student self-organizes experience & mental models via schemas (adaptation & co-evolution) | emergence of self-organized understanding & comprehension (non-linear emergence; fitness) |

within their internal models (i.e., prior knowledge). If an experience contains many regularities that already exist within the student's internal models then the experience is highly meaningful.

As students gain experience and actively identify regularities, these regularities will self-organize to form internal models. That is, the way that a student organizes their knowledge is a function of the student, not the experience. The experience may indirectly influence or intimate as to how this knowledge might be organized, but the actual organization is dependent upon the student and their existing internal models. In addition, as related knowledge coalesces, or perceived regularities cluster, a more cohesive entity begins to emerge—an internal model. These internal models provide both a framework for knowledge and a formulation of the integration of the knowledge. Thus, internal models emerge from the abstraction of

regularity and knowledge, and as such, are personal constructions of the student.

Finally, these internal models are continually re-engaged in various experiences to provide for adaptation. If the nature of familiar experiences changes, then new regularities or knowledge will be abstracted, and old internal models will be modified or new internal models will be constructed.

The preceding description has been fairly linear due to the constraints of written language; however, it should be noted and emphasized that this process of learning and adaptation is dynamic, cyclical, and very non-linear.

Complex Constructivism Principles

Complex constructivism principles are based on the shared fundamental tenets of both complexity

theory and constructivism theory. These principles provide a solid foundation for understanding the nature of learning in a complicated, dynamic, and culturally relevant world. Holland (1998) provided an excellent introduction:

> Despite the perpetual novelty of the world, we contrive to turn experience into models of that world. We *learn* how to behave, and we anticipate the future, using the models to guide us in activities both common and uncommon. Somehow, through learning, these models emerge from the torrent of sensations that impinge upon us at every moment. (p. 53)

1. Learning involves student adaptation to the environment. The concept that an organism alters its behavior to more effectively interact within its environment is common to both a constructivist and complexity perspective. For constructivists, this adaptation involves the construction of new mental structures, and the modification of existing mental structures, to facilitate students in interacting meaningfully and effectively within their sociocultural and physical environments. Eisenhart and Broko (1991) stated the constructivist perspective well: "Learning occurs as [students] make sense of instructional events by using their existing cognitive structures to interpret environmental stimuli. It also occurs as they modify and elaborate their knowledge structures through a process of adaptation to the environment" (p. 142). This concept of constructing and modifying internal models in order to adapt to an environment is mirrored in complexity theory. Martin (1999), in delineating the essential characteristics of a complex system, stated, "As a rule, these systems are *adaptive*; changes in their internal states occur in response to the environment" (p. 263). Indeed, Waldrop (1992) bridged the gap: "In fact, you can think of internal models as the building blocks of behavior. And like any other building blocks, they can be tested, refined, and rearranged as the system gains experience" (p. 146).

2. Learning involves the active construction of knowledge by the student. There are many types of constructivism; however, their unifying theoretical tenet is the belief in an active learner, a learner that actively constructs knowledge from experience. This construction process is responsible for students "internalizing" their culture and making sense of their environment. This act of construction applies equally well from comprehending basic math facts to comprehending cultural mores. Comprehending and making sense of an environment, as a complex agent, involves the active search for regularities. These regularities reflect knowledge of the environment and allow agents to successfully adapt. Therefore, from a complex constructivist perspective, students construct internal mental models by actively searching for regularities in their experience.

3. Learning involves the self-organization of knowledge and experience into internal models. Constructivism and complexity both emphasize that the organization of students' or agents' internal models is a process that is carried out exclusively by the student or agent. That is, the organization of a student's or agent's knowledge or internal model is not imposed on the student or agent by either an internal or external source. This does not negate the influence of society and the environment; rather, society and the environment have an indirect influence on self-organization, as an impetus for adaptation. Therefore, self-organization accounts for the individualistic or subjective nature of knowledge and "the view that learning is both a process of self-organization and a process of enculturation that occurs while participating in cultural practices, frequently while interacting with other" (Cobb, 1989, p. 41).

4. Learning involves the emergence of internal models as a natural consequence of a student's experience. The complex constructivist perspective posits the idea that internal models are not "actively constructed," but rather, internal models are "naturally emerging." This statement is not as antithetical to a constructivist view as it may first seem. Students' active construction involves the active search for regularities in their experience and these regularities represent knowledge. However, the internal models that provide the relational organization of this knowledge emerge as a natural consequence of knowledge acquisition. Thus, the knowledge is actively constructed while the organization is naturally emerging. Furthermore, these naturally emerging internal models provide the non-linear foundation for the concept that the whole, the internal models, is greater than the sum of the parts, the knowledge. "The ascending levels of the hierarchy of complexity demonstrate emergent properties at teach level which appear to be non-predictable from the properties of the component parts" (Cowan, 1994).

5. Learning is a function of both student interaction and existing internal models. Within constructivism, this complex constructivist principle combines the social interactionist views of the sociocultural constructivists with the personal constructivist views of the radical constructivists. This dualism also exists, although to a lesser extent, within complexity between the individual agent view of Gell-Mann (1994, 1995) and the aggregate agent view of Holland (1995, 1998). Cobb and Yackel (1996) provided support for this principle of combining the individual and the social by eschewing this duality and proposing an "emergent perspective" to constructivism

that integrates these two views. Yackel (1995) explained this relationship:

> The characterization of learning as an individual constructive activity is, therefore, relativized because these constructions are seen to occur as students participate in and contribute to the practices of the local community. . . . The link between collective and individual process in this approach is, therefore, indirect because participation enables and constrains learning but does not determine it. (p. 185)

Complex constructivism provides a new perspective on learning, a perspective that emphasizes both the active, self-organizing construction of knowledge, and the adaptive nature of those constructions. The complex constructivism perspective combines and addresses the common concerns of constructivism—

> A psychology that decomposes . . . thinking into its elements in an attempt to explain its characteristics will search in vain for the unity that is characteristic of the whole. These characteristics are inherent in the phenomenon only as a unified whole. Therefore, when the whole is analyzed into its elements, these characteristics evaporate. (Vygotsky, 1987, p. 45)

—and complexity, "Modeling the emergent characteristics of the mind presents probably the most difficult task for creating links between the hardware and software of human biology and the achievements of human consciousness" (Singer, 1995, p. 5).

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