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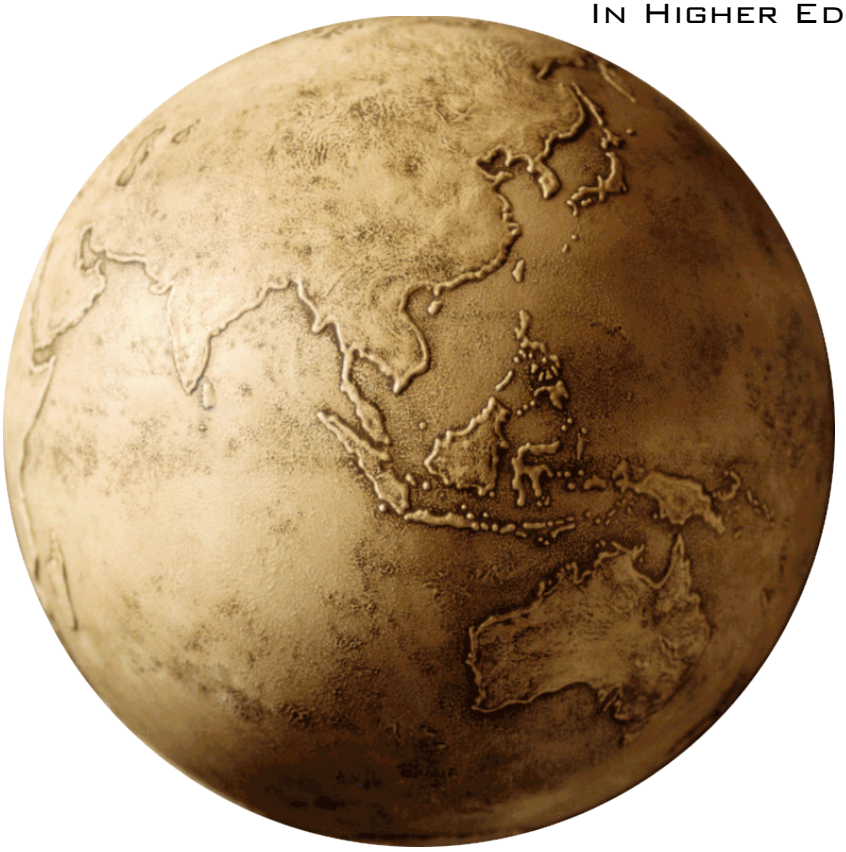

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Research Articles

Instructional Articles

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A Collaborative Teaching Approach: Views of a Cohort of Preservice Teachers in Mathematics and Technology Courses

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A collaborative teaching approach (CTA) between two instructors was implemented to develop more curricular coherence with the intents of reducing fragmentation and of stimulating learning across mathematics methods and instructional technology courses. The CTA was prompted by the need to streamline the learning outcomes, including an e-portfolio exit requirement for their program of study. Utilizing a case study approach to determine preservice teachers' levels of satisfaction, the actual learning effects, and the significant factors in the CTA, we found them to express overall satisfaction with the learning outcomes of the collaboration, and they suggested extended implementation.

In teacher education, the search for more effective forms of delivering instruction is an ongoing effort. Likewise, the integration of technology concepts with subject matter and instructional methodology are continual. There is also widespread agreement that the teachers, not technology, are the drivers that can bring about desired change in mathematics education. Thus, preparing teachers to use technology is a complex issue that must be addressed.

The National Council of Teachers of Mathematics (NCTM, 2000) has published a technology principle which states that "technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning" (p. 373). Technology integration in teacher education occurs at various levels of engagement with the teacher educator, the prospective teacher, and the student (Garofalo, Drier, Harper, Timmerman, & Shockey, 2000). NCTM challenges teacher preparation programs to provide models of good mathematics teaching to assist teachers in developing their knowledge of mathematics and mathematics-specific pedagogy. They should provide multiple perspectives on students as learners of mathematics along with opportunities for teachers to develop their own identities as teachers of mathematics (Borko et al., 2000).

Our initiatives were informed by mutual acceptance of the benefits of a collaborative approach to teacher training as well as by the evidence found in the literature. The unique contribution of this report is a description of the implementation of the collaborative approach in one mathematics education program at a large southeastern university that prepares prospective and inservice teachers for urban schools. Pertinent literature used to support the research study included several areas in teacher education, including collaborative teaching, development of e-portfolios, and reflective teaching.

In traditional teaching arrangements, students are enrolled in separate courses, and any integration that takes place is often achieved only by their own initiative. Many courses in higher education involve little faculty cooperation, and, in cases where collaboration does occur, instructors engage in team-teaching, addressing various topics under one content area (McDaniel & Colarulli, 1997). In response to instructional needs, creative and powerful models of instructors' collaboration are developed to promote integrative thinking in students. Coming from different disciplines, collaborating instructors integrate instructional content and methodology (McDaniel & Colarulli). Collaboration provides educators with the opportunity to model different ways of teaching, to respond to student needs, and to provide students with the chance to experience two instructors contributing to the instruction (Harris & Harvey, 2000). Therefore, this research was conducted by two instructors who collaborated, based on the need to assist their students make connections within their different courses and to document their progress in the form of electronic portfolios (e-portfolios).

Purpose of the Study

As instructors, we had observed and received consistent feedback from previous students who were faced with an overload in preparing different e-portfolios for different courses within the same program. Putting much thought into the students' concerns and the feasibility of designing a more coherent curriculum for the two courses, we intervened and collaboratively designed the discourse of the objectives of their courses. A collaborative teaching approach with the intent to reduce fragmentation and stimulate learning across two mathematics methods courses and one instructional technology course were implemented. The process of the collaborative approach is discussed further throughout the paper.

In this context, we define CTA as a process where we streamline preservice teachers' learning through

purposeful course design with the intent to reduce fragmentation across courses and to stimulate learning. Our rationale was to guide the preservice teachers' professional growth through the integration of pedagogy and technology. To determine the outcomes of the collaborative approach, the following research questions guided the study: (a) What are the significant factors of the collaborative approach? (b) Are there differing levels of student satisfaction with the collaborative teaching approach? (c) What are the actual learning outcomes of the collaborative teaching approach among students?

Review of Related Literature

The current educational needs consistently pose great challenges to educators and affect significantly the physical and social environments in which they work. The problem of designing learning environments to equip researchers and practitioners with the knowledge and skills they need in their work is real and current. Additionally, traditional teaching models applied in higher education do not always meet new and emerging goals. Collaborative teaching is one way in which educators can embrace the emerging goals of programs that seek to merge technology with pedagogy. This section of the paper explores the literature on the pedagogical aspects of collaborative and reflective teaching approaches enhanced by technology skills through the development of e-portfolios.

Collaborative Teaching

Support and collaboration constitute the guiding principles for improving instructional practice, and specifically teacher support is noted as an important instructional practice. Edwards and Hensien (1999) argue for the strong influence of efforts to support teachers and advocate providing teachers with regular feedback – a voice in curricular decisions in the enhancement of teaching. Moreover, successful implementation requires active and on-going support that is embedded in strong collaboration of effort. In addition, collaboration provides teachers with feedback in order to enhance their reflective teaching practice.

There are several advantages to collaborative teaching (Novicevic, Buckley, Harvey, & Keaton, 2003). First, this teaching approach can lead to learners' improved capability to evaluate problems critically, to argue substantively, and to apply effectively learned concepts to new situations or contexts. Second, the process augments the quality of teaching scholarship by transforming it into a participative activity with critical review and quality assurance. Third, collaborative teaching can be viewed as a means to achieve enhanced teaching outcomes because of its peer-reviewed and monitored nature. Additionally, it is structured to address multiple disciplinary perspectives. Fourth, collaborative teaching challenges traditional instructional delivery approaches. Its strength lies in the combined forces applied to address common goals or problems. If faculty goals vary in kind and nature, the outcome of the collaboration can be negative. In particular, if the goals and expected performance levels are not clearly defined at the beginning, team effectiveness can be affected.

E-portfolios

In the teacher education setting, the e-portfolio is defined as a purposeful collection of learner artifacts and reflections saved in an electronic format (e.g., disk, CD-ROM, website) to demonstrate how preservice and inservice teachers are meeting the current established standards for teaching. They are used as assessment tools providing learners with opportunities to showcase their academic work, teaching experiences, and technical expertise (Hewett, 2004). In particular, the e-portfolio is a way to document students' progress over time, identify patterns of growth and competencies in their teaching, develop their self-reflection and self-assessment skills, and improve overall teaching practices (Hewett 2004; Lankes, 1988). "Through portfolios students also come to see their meanings as something socially constructed over time rather than something they were born with but were unable to articulate fully" (Pullman, 2002, p. 151).

E-portfolios are gaining the attention in instructional settings by challenging holistically graded, one-time assignments and projects. Rather, the e-portfolios focus on cumulative growth (Gathercoal, Love, Bryde, & McKean, 2002). Nonetheless, they have been challenged as having setbacks which include cost, hardware and software, technical issues, pedagogical and software incompatibility, and classroom logistics. Despite these setbacks, e-portfolios do offer possibilities and have advantages over non-electronic portfolios, including opportunities for revision, reflection, and collaboration. In addition, e-portfolios are more portable, are easier to share or distribute, and require less physical storage space.

Reflective Teaching

Reflection and self-assessment are important to professional growth. Teachers deal with unique practical problems and manage complexities and nuances daily. They are faced with value judgments that cannot be resolved solely by applying theories or techniques. While research-based knowledge may begin to assist them in identifying solutions to the problems, teachers resort to resolving the context-bound problems

by mentally experimenting and manipulating each situation as it uniquely occurs. This leads to reflective practice, or what Schon (1987) termed "knowledge-in-action." In efforts to think about and react to current situations, Schon considered the notion of reflection-in-action, similarly noted as "thinking on your feet." Reflective practice focuses on the way people think about their experiences and formulate responses as they happen (Krause, 2004; Schon, 1987). Furthermore, when the thinking was about teachers' reflection-in-action, looking to their experiences, connecting with their feelings, and attending to their theories in use, it was termed reflection-on-action.

Reflective practice requires one to make sense of uncertain, unique, or conflicting situations of practice. It occurs at all stages of the teaching process: in planning, action, and evaluation (Moallem, 1997). In the three stages, reflection aids in making choices, monitoring progress and adapting to different situations, and reviewing what works, what does not work, and why. The cyclical action then helps in future planning (Krause, 2004). The process helps teachers to inquire, to further their learning, and to use intuition, insight, and artistry (Hinett, 2002). Thus, a reflective teacher, as noted by Moallem, is one who continuously questions his or her own aims and actions, monitors practice and outcomes, and considers the short-term and long-term effects upon each child. While reflective teaching has frequently been defined and justified in previous studies and models of instruction that have been developed, reflective teaching practice – its nature, function, and potential of reflection – has not yet been fully exploited. In Hart, Najee-ullah, & Schultz's (2004) model of the reflective teaching model, reflection-in-action and reflection-on-action are integral. The reflective teaching model has been employed as the conceptual framework guiding this study.

Conceptual Framework

The conceptual framework guiding this study is embedded in the reflective teaching model (RTM), which is employed in the teacher preparation program under discussion. The RTM is grounded in two theories: constructivism and metacognition. The assumptions are based on the values of modeling, sharing authority, reflecting, and heuristic teaching, which form the guide to the activities and experiences of the model (Hart, et al., 2004). During their course of study, the preservice teachers construct new knowledge about teaching and learning (constructivism), and they monitor their thinking and behavior as they regulate what they do and think while having an experience in teaching (metacognition; Hart et al.).

First, the preservice teachers have the opportunity to experience the Plan-Teach-Debrief sequence, while observing how others think about and teach from a reform perspective (modeling). Next, they are provided with opportunities to explore these concepts in their own classrooms. Collaboratively, preservice teachers model the first phase of the RTM, including planning with peers and a university supervisor (sharing authority). They are exposed to learning experiences and are provided with critiques. In the process, preservice teachers develop strategies for future exercises in "solving" the teaching problem (heuristic teaching). Based on this conceptual framework, the purpose of this research study was to determine the level of satisfaction with the collaborative approach among preservice teachers, the actual learning effects, and the significant factors in the collaborative approach. The instructors for the two courses were instruments in the process, and they were guided by this same conceptual framework.

Context of the Study

As instructors, we focused on addressing two aspects in both the pedagogy and technology courses. First, the preservice teachers were put in the position of reconsidering their ideas about the nature of mathematics instruction and in effect reconstructing more powerful ones through the RTM. Secondly, we worked with the preservice teachers in helping them integrate current research-based knowledge in both pedagogy and technology into mathematics education.

Mathematics Method Courses

In this secondary (6-12 grades) mathematics education intensive program of study, preservice teachers are enrolled in mathematics content and methods courses. The emphasis is on their enrollment in a mathematics methods course (Theory and Pedagogy of Mathematics Instruction) in the Mathematics and Science Division and an instructional technology course (Integrating Technology into School-Based Environments) offered by the Learning Technologies division. Preservice teachers are encouraged to enroll in both courses simultaneously. Previously, these two courses were offered and conducted individually without formal collaborative effort of instructors. As was stated earlier, we had observed and received consistent feedback from previous students who were faced with an overload in preparing different e-portfolios for different courses within the same teacher education program. The mathematics education instructor, collaborating with the instructional technology instructor, redesigned the

curriculum, not to diminish its quality, but to be more effective in providing an interdisciplinary approach to learning and teaching. The preservice teachers had to incorporate their experiences of mathematics teaching and reflections in the e-portfolio. An action research project that looked at a teaching or learning issue in the mathematics classroom was also showcased in the e-portfolio. The technology used in their classrooms, such as PowerPoint, Geometer's Sketchpad, the TI-83+ graphing calculator, and Excel programs, were examples of the experiences of the preservice teachers' involvement in the mathematics content and methods courses and the instructional technology course.

The RTM was implemented in the mathematics methods courses, and the instructor organized a model/experience/reflect format where the preservice teachers were exposed to planning, teaching, and problem-solving activities in their first summer. In addition, they experienced the activity, then reflected on those experiences at the close of the activity. The preservice teachers also followed a Plan-Teach-Debrief sequence in their practicum and student teaching experience where they participated in modeling activities in a classroom and collaborated and critiqued ideas with peers, cooperating teachers, and the methods course instructor.

Instructional Technology Course

The technology course incorporated a problem-centered, activity-based approach anchored in authentic and familiar contexts in which teaching and learning with technology occurs. This course supports the National Educational Technology Standards for Teachers and the Interstate New Teacher Assessment & Support Consortium (INTASC, 1992) Standards. The focus of the course was teaching, planning, introducing, and reinforcing technology integration methods for the K-12 technology-enhanced learning environment. While introducing and reinforcing technology integration skills, the focus of the technology course was teaching and planning methods for the K-12 technology-enhanced learning environment.

Throughout the course, the preservice teachers demonstrated their technology integration skills in a variety of activities that focused simultaneously on what they could do with the technology personally and on their abilities to plan for their students' use of technology to meet curriculum requirements. The preservice teachers developed unit plans, technology-infused lesson plans, and supporting Technology Integration Planning Skills Samples (TIPS), along with supplemental materials that included mathematics worksheets, grading rubrics, and handouts. The TIPS included web pages and webquests, Excel spreadsheets, PowerPoint presentations, Access databases, Inspiration concept maps, and desktop Publisher samples that demonstrated their ability to integrate technology into their selected units and lessons appropriately. Examples of lesson and unit plan content that preservice teachers developed included geometry, algebra, statistics, and calculus appropriate for grade levels 6 through 12. Upon completing the lesson plans, the preservice teachers were required to reflect on the lesson plan development process, the outcome of their microteaching, or the practicum experience upon implementing the lessons if they have had an opportunity to teach the lesson. The capstone project was the e-portfolio in which the preservice teachers documented the design and development of a technology-supported instructional environment that facilitated student learning through student-centered learning activities. The e-portfolio was a culmination of selected TIPS, unit and lesson plans, worksheets, grading rubrics, description of learning environments, and classroom arrangement. In addition, the preservice teachers were required to include their teaching and learning philosophy as well as their professional development plan.

The preservice teachers responded to three sets of reflections at the beginning, middle, and end of the semester in the technology course. Each of the reflection papers was guided by a set of questions from which they could develop their response. The questions sought to elicit preservice teachers' responses about course expectations, level of technology proficiency, continual growth and self-efficacy in the use of technology in the classroom, their beliefs about technology integration, and their ability to integrate technology into their content areas, as well as issues related to the course itself.

The preservice teachers also analyzed case studies from Roblyer's (2004) *Educational Technology in Action*. The cases selected for analyses focused on general teacher education and mathematics content areas. Expectations for case discussions were provided as follows: first, participants reviewed assigned cases and individually responded to specific questions from the textbook at the end of each case set. Next, they met in teams of three to discuss the assigned cases. Each team then submitted a group report based on their discussions. Finally, each student submitted an individual reflection on each case based on initial responses and group discussions. The goal of the case analyses and reflections was to enable the preservice teachers to begin examining how they might integrate technology and various instructional strategies into their e-portfolios and subsequently into lessons plans for future implementation.

Common Course Elements

Some of these experiences overlapped among two or three courses within the program of study. These experiences were particularly implemented in the student teaching internship using lesson plans developed with the use of technology, classroom management, and the mathematics content. Encouraging a comprehensive output of the students' work was intentional to depict technology integration, reflective teaching, reflective thinking, and collaboration.

The preservice teachers were required to develop e-portfolios in both the mathematics methods and instructional technology courses. A cumulative e-portfolio was also required at the end of the spring semester as an exit requirement for certification and their program. Every year, each outgoing cohort of preservice teachers presents their exit e-portfolios to the incoming cohort. This particular group of preservice teachers had the opportunity to view the outgoing students' presentations and to have their questions answered by the outgoing preservice teachers and instructors at the presentation. During the summer semester, the students presented their cumulative e-portfolios to their instructors. The two main purposes of the e-portfolios in this program of study were (a) to assess ongoing growth of the preservice teachers and (b) to assist students in preparing for the final e-portfolio, the exit requirement for their program of study. Among other items from selected coursework, artifacts in the e-Portfolio included a teaching philosophy, professional goals, technology-infused curriculum units and lessons, teaching resources and materials, a classroom management philosophy, a diversity philosophy and approach, descriptions of teaching and learning environments, evaluations and observations, and journal entries.

Both the mathematics methods courses and the instructional technology course used a blended approach, where instructional content was delivered using both face-to-face and online delivery modes (Govindasamy, 2002). The learning management system for instructional and communication purposes was WebCT Vista. Discussion forums and e-mail were used for communication and feedback within WebCT. Class notes and supplemental electronic resources and articles were also made available via WebCT Vista.

Participants

The preservice teachers enroll in a 45-hour, four-semester intensive program, which is designed to prepare them to teach in high needs schools in urban school districts. Before they can be admitted into the program, the preservice teachers must meet certain requirements. First, they must have an undergraduate degree or the equivalent hours in mathematics or a related field. Second, they must pass a rigorous selection and interview process for admission. These preservice teachers expressed their commitment and willingness to teach in urban schools. In their program of study, they are provided with a 6-week middle grades practicum experience in the fall semester and a 16-week high school student teaching experience in the spring semester. Except for one student teacher, all the participants had some prior formal classroom teaching experience. The participating cohort consisted of seven secondary mathematics education preservice teachers, of whom five were female and two were male; four were White, one was Asian, and two were of African descent. Pseudonyms are used to refer to the five preservice teachers who participated in the focus group interview at the end of the program.

Collaborative Role of the Researchers

Two researchers participated in the study. The first was a mathematics education instructor, who taught the methodology courses. The section researcher was an instructor in instructional technology. The collaboration began with our presence at the new cohort's orientation session to introduce the program of study and requirements. We discussed the criteria and the approaches that were to be taken to ensure the students had a rewarding experience during the courses and an effective e-portfolio at the end of their program. These meetings were an opportunity to clarify the desired instructional outcome early in the semester and in the program. This was also an opportunity for us to identify areas that needed reinforcement. The preservice teachers were provided with opportunities to seek consultation from the mathematics educator while being provided guidance from the instructional technology educator.

Considering the feedback received from previous and current students and our own observations, we met prior to the fall semester and reviewed the requirements for the two courses in mathematics and instructional technology. The information gathered was used to determine overlapping items and instructional content and to develop collaboratively a plan to incorporate common main items and criteria for developing the final product of the e-portfolio.

Several practices and approaches were embraced. We felt it was imperative to revise the syllabi together in order to represent the mutual learning goals. It was also of great importance to plan and synchronize class agendas, coursework, and schedules in a manner that would assist students in integrating their work seamlessly in both courses. Debriefing between the two of us was also pertinent, and we met on average twice a

month for 30-60 minutes in order to determine areas of success and those that needed modification. In addition to teaching the courses, the roles of the researchers included acting as primary instruments for gathering, analyzing, and interpreting the data.

Data Collection Methods

Qualitative methods consisting of classroom observations, instructor notes, course evaluations, students' reflections, examination of course artifacts, e-portfolios, and end–of-course focus group interviews were used to gather and analyze the data within this case study. As suggested by Yin (2003), the case study design is an appropriate way to investigate the causal links and the context relating to an intervention. It is also useful when there is little or no control over the behavioral events. The unit of analysis in this case study was a cohort of mathematics education preservice teachers enrolled in a four-semester teacher preparation program. Focus group interviews were conducted to elicit technology integration in teacher education occurs at various levels of engagement with the teacher educator, the [prospective] teacher, and the student (Garofalo, Drier, Harper, Timmerman, & Shockey, 2000).

Presentation of Data and Analysis

We, the two instructors of the two separate courses, met twice a month during the semesters to discuss course outcomes and emerging data. Each of us was responsible for analyzing the datasets. To manage the data, we used a qualitative data management software tool, Nvivo, to organize and run data reports. Content analysis was used to categorize concepts and ideas that emerged in the two courses (Merriam, 1988).

According to case study methodologies (Miles & Huberman, 1994; Yin, 2003), we used pattern matching in the within and cross-case analyses used to address the research questions. During each analysis phase, we examined the cases for discrepant evidence and rival themes in order to assure the rigor of the analysis. Triangulation within and between data sources provide a holistic picture of the phenomenon and provide corroborating evidence (Creswell, 1998) as findings emerged. Our three research questions were answered by themes that were directly related to the questions, and sometimes there were overlapping themes.

Findings

Data were analyzed and findings taken into account in reviewing strategies and refining the collaborative approach with the incoming cohort. The guiding research questions were intended to determine the significant factors of the collaborative approach, students' satisfaction with the approach, and the students' learning outcomes. A common thread to all three questions was the development of a reflective, constructive view of integrating technology into mathematics education. Based on our data collection, the themes that arose and the meanings that emerged are discussed below.

Impact of Coursework

The preservice teachers expressed that taking the courses concurrently gave them the awareness of what was current and relevant to their future careers. Rose stated that she thought, "being knowledgeable about the technology updates is very helpful even though some might not have a computer at home . . ." Joe echoed this by saying ". . . we did not have the screen and projectors, but I know for a fact that I would not have made any effort to do it without a computer, unless I had taken these classes that had encouraged me to do it." Although particular schools may not have the specific hardware and software, having been made aware of the different options created an awareness of its availability, and thus they could ask for it.

The coursework in both courses went beyond hands-on technology application and included technology integration strategies. As a result of taking the courses together, the preservice teachers began to explore ways in which they could access resources that were not available to them. Annabelle summed this up by talking about the different ways to get access to the resources that they could use in their future classes:

> Read about new technology. . . . If the school does not provide it, see if you can write a grant to get the new technology, but just being aware of new technology helps because they help you to do things in a better way or quicker way or more creative way. Read about them in online magazines, journals . . .

In particular, the preservice teachers stated that they enjoyed working on the assignments as an integrative project. The fact that they could work on different aspects of their coursework and pull it together into a larger project was seen to be beneficial to making interdisciplinary connections. For instance, Joe commented,

> I really appreciated that because I thought the typical college experience would be that I would have these two very similar projects that I would have to keep completely separated, but to the able

> to overlap them and integrated them together in one portfolio it was really – it made it a whole lot more fun.

It was especially important for the preservice teachers to be able to draw connections between the theory course and the instructional technology course. Rose articulated this by noting that in the theory and pedagogy course they learned "what they should be doing as teachers," and in the instructional technology course they learned "how to do it." For example, learning how to write lesson plans in the pedagogy class and then being able to design lessons that integrate technology were very appealing to the students. For this reason, the preservice teachers suggested that taking the courses independently would have been "a different experience."

Cumulative learning was a positive outcome of the learning experience, which aggregated into the e-portfolio, and it was particularly useful for various reasons. First, the e-portfolio was a significant factor in assisting the preservice teachers in keeping records of all their coursework electronically, and then being able to organize it in a singular place, such as a CD-ROM or a website, was beneficial to the students. Second, the e-portfolio was seen to be important to the reflective process as students had all the information relevant to them organized in a meaningful manner. The students submitted work for review and received feedback, which they then incorporated into the samples that they placed in the portfolio. In this way, they were able to keep records and different versions of their assignments and projects and were able to see continual growth throughout their course of study as stated by Rachael:

> I think the e-portfolio is great, I have everything since we started in the program, so anytime that I need something I just go to my e-portfolio and it has my classroom management plan, it has all my philosophy, the RTM, maybe it has the comparison we did from different times we taught and taped so we can always go back and reflect on the learning process, and you can get the feedback.

The third outcome was being able to use the contents of their e-portfolios in their own teaching. This could be done in one of two ways. First, they could use the materials they developed such as lesson plans for teaching mathematics content. Second, the preservice teachers could use their own e-portfolios as exemplars and then assist students to create their own projects. Amelia came up with the example to "use e-portfolios for our kids to show how they have gone [grown] during the year from beginning to end." In addition to learning's cumulative aspects, the idea of seamless integration was important to developing the e-portfolio. Hence, duplicating their effort was not seen as an effective way of learning both the pedagogy and technology skills and knowledge.

Reflective Thinking

The preservice teachers were exposed to the reflective teaching model at the beginning of their program. The model was demonstrated to them during a methods course in the summer semester, and subsequently they modeled it in their micro-teaching assignment. In the fall semester, they then modeled it again in their practicum experience at the middle school. In the spring semester, they demonstrated the model in their student teaching experience at the high school. The students reflected on the pedagogy and on technology when it is used. Part of the RTM is to critically reflect on practice. Students developed these skills over the three semesters. Through this model, the preservice teachers developed skills in collaboration, cooperation, reflection, and the ability to accept constructive criticism. In their mid-term and final reflection papers the preservice teachers felt that they had grown professionally as a result of their coursework and their student teaching experiences

In the process, an awareness of reflective thinking was demonstrated in the preservice teachers' e-portfolios. Over time, they moved from looking at the RTM from a theoretical perspective and began to apply aspects of the model in their own coursework and practicum experiences. Reflective thinking is reinforced in the RTM. In the e-portfolios, the preservice teachers demonstrated their development through the RTM process, artifacts, assignments, and their performance as it aligned and met the INTASC standards. The feedback they received from their cooperating teachers during the RTM process was also demonstrated as a motivator to continually revise their practice throughout the program. Annabelle stated,

> I think is [it's] good. We learned a lot about the reflective teaching model, how to reflect, so it is like throughout the program we kept on adding to the E-portfolio, modifying it, refining it, removing one thing and putting another; it helps you to reflect. I think that ['s] the major on[e] for the e-portfolio, that is, if we go back and look at it.

Being able to see the connection between the coursework and the final output was part of reflective process as was exhibited in use of the case studies from Roblyer (2004) that the students were required to analyze and reflect upon. One requirement was for the preservice teachers to draw deeper connections between the scenarios in the case studies and to make them more relevant for their e-portfolios. They felt that the cases

were realistic simulations that they could typically encounter in their own teaching. During the group reflection process, they discussed different ways in which to deal with similar situations. However, they expressed that the pay-off for the reflective process of case study analyses was not as big a payoff as that of working on the e-portfolios. These preservice teachers suggested spending less time analyzing the cases and more time on Mathematics software such as MathLab™ and Maple™.

Collaboration

Explicit and visible collaboration between the two faculty members was a significant factor in the success of the collaborative teaching approach. At the beginning of their program, during orientation, the preservice teachers had been made aware that the two of us were working closely together on curriculum development. Although the collaboration was reiterated often throughout the semester, the preservice teachers really began to see the outcome of the collaboration later in the semester, when they began to apply the concepts learned in the two courses. As the preservice teachers approached the completion of their program, revisiting the skills and knowledge with which they interacted during their course of study, they began to recognize further connections. Joe said,

> . . . they [instructors] did a good job regarding flexibility, breaking things out . . . I mean, truly, there were so many times over the course of the term that [the] two professors only talked to each other to see if . . . they were covering sort of the same thing[s] but they really made those two classes a lot smoother. . . .

Rose stated, "At first I did not realize how much they did and collaborated, but then you realize, 'Oh! It is not just coincidence that this goes together,' so I think they did an excellent job."

Extending the collaboration to other content areas was seen to be important by the preservice teachers. In the particular context of the mathematics students, the students expressed that the approach would have been even more enriching by incorporating more mathematics content, such as mathematics content courses that involve the use of computers. Therefore, the recommendation for collaborating between pedagogy, instructional technology, and content-specific coursework would have helped the students draw the three areas together. Extending collaboration to include other faculty members was recommended. Joe commented, "I know that is impossible to do [collaborate] between all the professors, but two thumbs up for them who did it."

As part of their orientation into the program, the incoming students met and interacted with the outgoing group. During the process, they received the opportunity to view the previous group's e-portfolios, and this helped them to form expectations of what would be required of them during their program of study. Rachel stated,

> I actually looked for that IT class because before the course started, when we were seeing other senior portfolios and I was kind of impressed by that, and they told me that had learned all that in that IT class, so I was looking forward to it.

Beliefs and Attitudes

Students appreciated the assistance they received from both courses. They stated that they were excited about using technology in the classroom and were comfortable using various hardware and software. These preservice teachers expressed the general feeling that technology is relevant and good and that more technology is needed in the schools now than ever before. Being knowledgeable about the technology and the updates is very helpful because even though some students might not have a computer at home, they are often around computers, and they know a great deal about the technology. Therefore, as a teacher, it becomes important to be aware of the current trends in order to incorporate pedagogical aspects of the process.

Initially, the preservice teachers were not sure that they would get much out of the course because they assumed that teachers just use overheads and computers, and many of them already knew how to do so. Amelia stated, ". . . [I]nitially when I saw the syllabus I thought it was going to be a lot of basic work, but I think the projects and assignments really helped to kind of simmer in what we were learning in class." However, it turned out that the preservice teachers were motivated to find new and creative ways of integrating technology, such as graphing calculators and Geometer's Sketchpad software, into their own coursework and as instructional tools. The preservice teachers also expressed growth and reduced anxiety using technology. They expressed satisfaction from the experience of having a class that directly addressed the development of an e-Portfolio. Joe commented,

> I really, honestly, could not have done my E-portfolio without the IT class; I mean, not even close, for me it would have been a tremendous amount of time and energy, and I would have died trying to do it. That IT class was absolutely essential to getting any kind of good portfolio.

Learning Outcomes

One significant outcome of the coursework was increased integrated technological and pedagogical skills and knowledge. The preservice teachers noted that during their program of study, they began using technologies that they were already familiar with in more innovative ways beyond the basic use. These innovative uses of technology were also demonstrated the following spring semester when preservice teachers enrolled in the practicum experience. For instance, Joe noted that he now viewed PowerPoint® as a "tool that captures students' attention whilst transforming information." In addition the preservice teachers indicated an increased comfort level when incorporating different technologies in the classroom. They reported this as being able to incorporate different technologies that they had explored in the technology course. As noted earlier, they were developing lesson plans that used technology integration for use during their practicum. These lesson plans that they created were subsequently incorporated into their e-portfolios. The preservice teachers indicated they were more likely to use technology in instruction, as they felt more comfortable exploring different ways in which they could incorporate the new tools that they were being exposed to in their coursework. For instance, they came up with examples of how they could incorporate software such as Geometry SketchPad® into lessons.

Another significant output was learning how to develop the e-portfolio itself. This included learning how to use the different software packages and then incorporating mathematics content in the technology course. The process also involved problem-solving skills to develop an organized and comprehensive final product. Being able to use the e-portfolio as a way to showcase their work was an added advantage. Further, the preservice teachers could provide samples of current projects to indicate their currency with various skills and standards. For instance, Annabelle suggested,

> It is good for when you are seeking employment, to show whoever is going to be your future employer what you have done and actually to go through and say, okay, you did this, and with all we have learned to do and actually did it and putting dates it will look rich to anybody, so those are the two advantages of it.

Annabelle's comment stimulated further discussion on the ways in which exchange of information occurs. The preservice teachers began to compare their own presentation formats with what was currently being used in the schools. Joe stated,

> I have to turn in our portfolios in February at the school for our department head. I am just going to take some stuff I did this semester and shift around the structure of what I got and turn that in, which might really freak them out because I think they got all big huge binders, because these teachers have been keeping them like for ten years.

Technology Issues

The issue of access and availability of technology was raised by the preservice teachers. They expressed concern that having access to technology resources at their future schools would be important to their success as teachers. Joe expressed that ". . . the availability to get it [the technology] is an issue." The preservice teachers also recognized the options and possibilities that were available to them to use in their future classrooms, in the form of physical resources, software, and electronic online resources. They talked about accessing resources, such as lesson plans, online and adapting them to their individual classes. One of the concerns expressed was the realization that many of the public schools did not have everything that they would need to maximize on the advantages of having electronic resources. Annabelle stated that "if it is there, it will be good!!! Because most of the public schools do not have everything you need."

Discussion

The CTA was geared toward providing support and facilitating the preservice teachers' personal growth of knowledge about teaching. We, the instructors of these courses, believe Harris and Harvey's (2002) assertions that facilitating critical thinking, providing teaching and learning opportunities, and reflecting on knowledge is important to our students' professional growth. Another belief is that engaging in professional collaboration can be influential in effecting change in instructional practices (Edwards & Hensien, 1999).

Throughout the activities of this study, the reflective teaching model, a pedagogical tool for us to plan, teach, and reflect (debrief) was the guiding framework for both instructors and preservice secondary mathematics teachers. The instructors planned the collaboration, then taught the preservice teachers to collaborate throughout the course and allowed them to reflect in class, through assignments and through a focus group activity. Hence, both instructors and preservice teachers were guided by the model. As noted, the group discussions were important to providing our students with a context to practice reflection-on-action (Schon, 1987), looking back on an incident, as well as reflection-for-practice, what they would do differently. We believe that reflective practice

leads to reflective teaching, and thus we emphasized this in both courses. The preservice teachers expressed their views about the RTM, their overall experience in reflecting on the cases, receiving peer input, gauging their own professional growth and development, and making connections to other coursework and practicum experiences culminated into an overall reflective process.

Several outcomes were expected. First, we hoped that when the preservice teachers observed the collaboration between the two instructors, they too would begin to explore avenues of collaboration with their peers and future colleagues. As indicated in the outcome of the study, the preservice teachers in this study acknowledged the collaborative efforts that were put in place to assist them in integrating course content. Second, the preservice teachers were provided with opportunities to seek consultation from the mathematics education instructor while being provided technical guidance from the instructional technology instructor. Third, we envisioned that sharing the outcomes of the collaborative approach with other colleagues across the department would open additional avenues of collaboration and encourage further activity with other colleagues across the department and in other content areas.

Increasingly, teacher education programs are recognizing the need for preservice teachers to be able to solve ill-structured problems and then to incorporate instructional experiences into their curriculum. Hence, the mutual interaction between learners and instructors and among learners themselves seems to have special importance to high-quality learning. Learning seems to occur when the social context provides opportunities for authentic just-in-time learning, incentives, and support. This social interaction seems to enhance problem-solving and development of metacognitive skills through reflective dialogue (Enkenberg, 2001).

The collaborative approach was designed to develop more curricular coherence for students with the intent of reducing fragmentation of the curriculum and to stimulate learning across mathematics and instructional technology courses. Outcomes of the collaborative approach can be used to determine needs in curricula and options for aligning common goals (Novicevic, 2003). In addition, the instructors wanted to model collaboration not only at the student level, but at all levels. It was therefore intended that refinement of the collaborative approach would be further developed into a model that instructors can adapt to other content areas within their programs. Students get the opportunity to document their personal educational development as well as learn and practice their technical skills. As noted by Rodgers (2002), a community of practice is a place where reflection should ideally occur through interacting with others in the community. Hence, reflective knowledge requires one to make sense of uncertain, unique, or conflicting situations of practice. Teachers who reflect and consider the affordances and constraints of a technology and its alignment with their own teaching philosophy are more likely to integrate technology (Zhao, Pugh, Stephen, & Byers, 2002).

Reflection is emphasized in this alternative teacher preparation program under study. We believe that reflective practice leads to reflective teaching. We also believe that the development from novice to expert occurs from instruction, professional maturation, and personal experiences (Hart et al, 2004; Schon, 1987). The importance of teacher reflection to the process of change in instructional practice is not limited to teachers of mathematics but extends to other areas as well. In instances where collaboration does occur, faculty members usually engage in team teaching (McDaniel & Colarulli, 1997). However, as noted, many courses in higher education involve little faculty collaboration and often rather engage one faculty member teaching students in his or her course alone.

Conclusion

Overall, the preservice teachers expressed satisfaction with the learning outcomes of the instructors' collaborating. They provided commendations about what worked well and recommendations for improvement. These comments were incorporated with the subsequent cohort of preservice teachers who joined the program the following academic year. The preservice teachers indicated that they were excited about learning different aspects of technology integration, although the technology course was viewed as "busy." However, they acknowledged that the projects and assignments helped to "simmer in" the content from their coursework. As collaboration continues to be used in educational research and teaching, it is important to pay close attention to the nuances and intricacies of the relationships that are formed (Rodgers, 2002).

As technology continues to be infused into curricula, educators should continue to seek ways in which technology tools and resources, including e-portfolios, can best meet learning goals and objectives (Zhao, et al, 2002). As identified in this study, there are overlaps in content areas that can be addressed when instructors come together to share skills and knowledge in their different content areas for the mutual benefit of enhanced student learning. Thus, the use of e-portfolios is one such forum for presenting pertinent information in a manner that is convenient and accessible to both the students and their instructors. When students go through their programs of study, the e-portfolio is a useful tool for depicting professional growth over time

as it can accommodate multiple documents and artifacts. Finally, when the students experience different instructors and take a variety of courses, it is a convenient way for them to make connections within their coursework in their program of study. If instructors can seek ways to bring content and processes together, then the process is further streamlined.

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Material Mediation: Tools and Representations Supporting Collaborative Problem-Solving Discourse

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This study investigates how a variety of resources mediated collaborative problem solving for a group of preservice teachers. The participants in this study completed mathematical, combinatorial tasks and then watched a video of a sixth grader as he exhibited sophisticated reasoning to recognize the isomorphic structure of these problems. The preservice teachers used a variety of material tools to solve the same problem, construct explanations of the learning processes that the sixth grader engaged in, and pose further questions about the problem to clarify their solutions. The results of this study suggest that simple material tools helped to motivate and mediate the participants' collaborative problem-solving discourse.

Since Vygotsky (1978) described the importance of mediation to situated learning, researchers have been examining the interplay among agents, tools, and activities (Cole, 1996; Engeström, 1999). Because tools play such an important role in sociocultural theories of learning, our research question focuses on how tools mediate collaborative learning in a higher education setting. Tools both guide and constrain learning activities by allowing learners to engage in some kinds of activities and preventing them from engaging in others (Pea, 2004). This is particularly important as teacher education programs and higher education institutions in general move to collaborative and learner-centered models of teaching (e.g., Ball & Wells, 2006; Darling-Hammond & Hammerness, 2005; Herrington & Herrington, 2006), such as problem-based learning. Problem-based learning is a collaborative, student-centered approach to instruction in which students learn through solving problems (Hmelo-Silver, 2004). In these instructional models, the teacher serves as a facilitator of learning, often working with multiple groups, and the tools available in the environment serve to support student learning and activity (Greeno, Collins, & Resnick, 1996; Hmelo-Silver, Duncan, & Chinn, 2007). Despite the importance of tools in such environments, and much theory about how they should mediate learning, there is not a lot of research on the role of tools in collaborative learning.

This research examines how a group of preservice teachers used different tools as resources for mediating collaborative discourse while engaged in a problem-solving task. In the problem-based learning classroom we observed, each preservice teacher group was asked to work together to solve a mathematical problem and later analyze a videocase of a middle-school student solving the same problem. We describe how one group used a variety of different tools during their problem solving as contribution to the research on mediational tools in collaborative learning and problem solving in higher education. This is an important issue as problem-based learning and other collaborative, student-centered approaches are being increasingly used in diverse higher education settings (e.g., Herrington & Herrington, 2006; Major, Savin-Baden, & MacKinnon, 2000; te Winkel, Rikers, & Schmidt, 2006). Our research questions are twofold. The primary question is how material tools and artifacts mediate collaborative learning. As we began investigating this question, student's beliefs about the way that he or she used these tools and artifacts emerged as a secondary question.

Material Representations and Mediation

Cultural artifacts and representations are tools that people can modify to regulate their goal-directed activities (Cole, 1996; Engeström, 1999; Pea, 1993). As these tools organize and constrain human activity, they can help structure people's thinking and action. Our focus in this study is on designed artifacts (such as manipulatives) and written representations (such as diagrams). Such use of material mediational tools allows difficult and elaborate reasoning tasks to be distributed into the physical environment.

Mediation is one of the basic principles of cultural historical activity theory (Cole, 1996). Tools are artifacts or representations that can be used to modify human activity. They may be either external (such as a poster or a computer) or internal (such as language) mediators. Tools exert a strong influence on physical and mental operations. Finally, tools serve a communicative purpose and can be used by individuals to exchange knowledge with their peers. Thus, tools and representations are more than just inert paraphernalia. They are imbued with cultural meaning and become key mediators that partially direct resulting human actions (Engeström, 1999). Researchers have demonstrated the important role of tools in mediating problem solving. For example, in a study with middle school children, Barron (2003) found that artifacts in

the form of workbooks served as centers for coordinating collaborative mathematical problem-solving. Stevens (2000) analyzed the affordances of paper and computer-based tools for supporting collaboration in both middle school children and professional architects. He explored different forms of collaboration, asked why particular tools were used in particular ways, and found that paper tools afforded participants greater means to creativity, flexibility, and availability (among other affordances) over technological tools. We focus here on the tools and representations that figured in one group's collaborative problem-solving processes during work on two related tasks. We were interested in what tools were at the group's disposal, how they were used, and how they served to mediate collaborative problem-solving processes. This is a particular issue in teacher education because many teacher education pedagogies, including the problem-based learning approach in this study, are designed to help preservice teachers build the tools and practices needed for close analysis of teaching and learning (Darling-Hammond & Hammerness, 2005).

Relationships Between Shifts in Tool Use and New Mathematics Activity

Mathematics educators have documented that changes in the way students use mathematical tools can afford students the opportunity to participate in new mathematical activities. Further, in some cases, the new activities that students participate in may be critical in advancing students' mathematical thinking (e.g., Gravemeijer, 1999; Rasmussen, Zandieh, King, & Teppo, 2005). One such distinction is Gravemeijer's (1999) model of/model for dichotomy. At first, students may use physical tools (e.g., manipulatives) or written tools (e.g., a graph) to model a mathematical situation. At this stage, students are using these tools as a representation system for the purposes of understanding and description; the tools are used as a model of students' mathematical activity. Subsequently, students may view representation systems that they produced as interesting mathematical objects in their own right, and they may proceed to investigate the systems' mathematical properties. Students regard the tools they are using as a model for mathematical investigation. The shift from viewing tools as representing mathematical situations to becoming mathematical objects worthy of investigation in their own rights affords students the opportunity to engage in mathematical abstraction.

Similarly, when students engage in mathematical activity, they usually write inscriptions to mediate their work. Initially, these inscriptions may aid learners in completing a particular task, serving functions such as objectifying important mathematical ideas, assisting in calculations and manipulations, and reminding the students of what findings have been established (Harel & Kaput, 1991). Later, these inscriptions may be used as records of their mathematical activity, signifying mathematical activity that transpired (Cobb, Boufi, Whitenack, & McClain, 1997; Rasmussen & Marrongelle, 2006). These shifts enable participants to objectify their previous activity and make it an explicit subject of discussion, affording students new opportunities to justify the validity of the solutions they obtained (Cobb et al., 1997) and to advance their mathematical thinking by considering more abstract mathematical ideas (Rasmussen, Zandieh, Teppo, & King, 2005; Rasmussen & Marongelle, 2006). We will illustrate how one group of preservice teachers' experience with Unifix cubes in problem-solving and their observations of a student using these manipulatives led them to appreciate the mathematical and pedagogical values of these tools.

Tasks Used in This Study

The tasks used in this study are well researched in mathematics education as part of a longitudinal study of children's mathematical reasoning (Maher & Martino, 1996, 2001; Martino & Maher, 1999). The first task asks students to try to find all the possible ways to build towers with yellow and blue blocks that are four blocks tall and to justify that they have found all possible combinations. The second task asks students to list all the possible pizzas that could be ordered if four toppings were available and, again, to provide a justification that all combinations were produced. These two problems are isomorphic, as they share the same deep mathematical structure. For the first task, there are two choices for each block (blue or yellow), there are four such decisions to be made (one for each of the four blocks in the tower), and each of these decisions can be treated independently. Hence, there are $2^4 = 16$ possible towers. Similarly, for the second task, for each pizza topping, there are two choices that can be made (include the topping or not), there are four decisions to be made (one for each topping), and each decision is independent. Again, there are $2^4 = 16$ possible pizzas. In prior research, children's use of representations moved from strategies embedded in concrete artifacts to a later emphasis on more abstract, written representations (Maher & Martino, 1996). Earlier research demonstrated that as students connected representations, they reorganized their thinking and were able to construct the isomorphisms between the problems.

Methodology

Setting and Participants

The setting for this study was a semester-long course at the graduate school of education at a large, northeastern, United States university in 2003. The goal of the course was to have preservice teachers understand how learning principles applied to different types of classroom practice. Key participants in this research were the six students (2 male, 4 female) of Group 5: Bob, Caitlin, Liz, Helen, Carla, and Matt (pseudonyms). The students were all enrolled in a problem-based educational psychology course for preservice teachers. They were all between the ages of 20 and 30, Caucasian, and working on completing their respective teaching degrees. The students' major areas of study were varied, but none were Math Education majors.

First, students had to work on solving mathematical proof problems on the mathematical topic of combinations. They needed to prove that they had determined all of the possible combinations that could be created using two different color blocks in four-block-high towers. During one class session, the participants were provided with Unifix cubes in two colors (yellow and blue), and they needed to figure out how many differently patterned, four-cube-high towers they could create using the cubes. The students were clustered together in a circle, seated at individual desks, discussing the "block problem" (i.e., how many four-tall towers can one form with blue and yellow blocks?). Each of the six group members had a number of the Unifix cubes on their individual desks as they tried to justify they had identified all possible combinations that were four blocks high. Some group members manipulated the stacking blocks; others did not. As a group, they talked to one another and asked questions about different mathematical explanations that provided a proof.

In a subsequent class session, the group had to solve a related problem where they had to determine the number of different pizzas that could be made with four different topping options. In this exercise, the group was not provided with any manipulatives, such as blocks or plastic pizza shapes to work with. Although the block problem and the pizza problem were isomorphic, the group members did not use an analogous strategy to solve the pizza problem as they used to solve the block problem. For example, the students did not seek out or create concrete representations of the four different toppings and play around with different pizza combinations. Rather, the students used their knowledge of algebra to pose that 2^n n-tall towers could be formed with yellow and blue blocks and that 2^n pizzas could be created if there were *n* toppings to choose from. Three of the students seemed to have a partial understanding of this formula, but the remainder of the group had trouble grasping the connection between the algebraic formula and the blocks on the table in front of them.

After engaging in their own problem solving with the block and pizza problems, the group studied a videocase of a sixth grader, Brandon, solving the same pizza problem using stacking blocks and a chart that he had constructed. The group needed to analyze Brandon's thinking and identify the learning and reasoning strategies he employed while engaged with the mathematical problems (Maher, 1998). The group had several tools as available resources during problem-solving: 1) plastic stacking blocks (Unifix cubes) in blue and yellow, 2) adhesive paper whiteboards, 3) markers, 4) transcripts of Brandon and another child interacting while working on the pizza problem in class, and 5) a computer simulation of the block problem.

Data Collection

Methods of data collection included 14 hours of digital video of the group (eight class sessions) and transcripts from stimulated recall interviews with two of the participants. The primary form of data collection was the digital video from four of Group 5's class sessions in which the preservice teachers were working on the mathematics problems. Once the video was catalogued, sessions were reviewed with emphasis paid to moments that pointed to patterns of effective collaboration skills or use of various materials. The video was reviewed again to identify short clips of significant moments that ideally portrayed the following research concerns: 1) group work with shared representational media (i.e., blocks, paper whiteboards, posters) and 2) ways in which the use of mediating materials made evident some sensible interactions, patterns, or meaning(s) within group collaboration. Six clips (ranging from 1 to 3 minutes long) were selected and then transcribed in preparation for coding.

Stimulated recall interviews (Shavelson, Webb, & Burstein, 1986; Fontana & Frey, 2000) focused on obtaining the participants' explanations for what was captured in each of the significant clips. The protocol for the interview was inductive and consisted of open-ended questions designed to elicit descriptive responses from the participants regarding aspects of the significant clips. While core questions were identical for participants to compare different responses to the same prompt, probe questions varied in order to allow participants to express their thoughts about the different clips. Participants were questioned individually while viewing the video clips taken of their group work. These clips were played, one at a time, by each participant. Participants were encouraged to pause,

rewind, or stop the video during discussion of the clip and protocol questions. Each participant was encouraged to reflect on the segment in his or her own words, and all discussion for a particular clip ended before moving to the next clip.

There are several benefits of the stimulated-recall interview format. One is that participants are able to "re-live" events that may have occurred some time in the past. They are able to pause time (in a sense) and reflect on a particular moment or closely examine events by manipulating the data medium (Bloom, 1953; Calderhead, 1981; Cresswell, 1998). In addition, both the interviewee and the interviewer are able to stay closer to the actual events, as opposed to asking questions removed from the event in both space and time: "Data elicited in this manner are likely to have greater ecological validity…more readily applicable to real conditions of work that data generated under more artificial circumstances" (Jordan & Henderson, 1995, p. 50).

Data Analysis

Analysis of the data was achieved through grounded theory methodology (Strauss & Corbin, 1998) in order to determine themes latent in the corpus of the video (as well as the discourse) data. Using grounded theory techniques, we began by dividing all of the data into episodes—short stretches of participant interaction that were bound by a common thread or topic. After episodes were identified, they were broken into smaller codable units—turns (within the episodes). Turns were coded using grounded theory methodology to facilitate the building of descriptive and dominant themes (Strauss & Corbin, 1998). Both the video and audio transcripts were thus divided into episodes, examined by turns, and coded dispassionately (i.e., without a priori labeling) but with an alert discernment for various types of tool use by the participants, discussion about tools and mediation, and evidence of social and/or material mediation as affecting the group's problem-solving discourse. The coded data turns that resulted from this analysis were then organized in terms of themes. The formulations of our hypotheses concerning the role(s) of material mediators occurred before, during, and after data collection and analysis. We constantly compared the similarities and differences of coded data in order to distill the data corpus into different categories. Portions or instances of data that did not directly relate to research concerns were eliminated (i.e., turns coded to indicate social talk) in order to reduce the data. Certain themes were collapsed into the same dominant category if their key components described the same basic observation or behavior.

The following is a data excerpt from a stimulated recall interview with Caitlin that took place on 8/21/03. This dialogic exchange was categorized as an episode, as it was a short stretch of participant interaction bound by a common thread or topic:

> Elvira: That's very interesting because you, you know, you said because you didn't really use the blocks at all.
>
> Caitlin: Yeah, so maybe, you know maybe I was using them and not even realizing it (She is speaking while watching clip 3 on the computer)... Yeah, no that was probably definitely...'cause I mean, I can see from…from looking at this (watching the clip and pointing to herself on the computer monitor), I was definitely using the tools, maybe I just didn't even realize that I was using it at all.

This episode was then broken down into smaller codable units known as turns (each turn begins on a new, starred line in the example following this paragraph). The codes that were assigned are in the square brackets following each turn. Turns were coded without a priori labeling, but with discernment for tool use and material or social mediation:

> *Elvira: That's very interesting because you, you know, you said because you didn't really use the blocks at all. [Code/s: researcher probe; using visual manipulatives]
>
> *Caitlin: Yeah, so maybe, you know maybe I was using them [Code/s: using visual manipulatives; tool use by individual; tool use within group work]
>
> *and not even realizing it [Code/s: intuitive tool use]
>
> *(She is speaking while watching clip 3 on the computer)... [Code/s: stimulated recall]
>
> *Yeah, no that was probably definitely...'cause I mean, I can see from…from looking at this (watching the clip and pointing to herself on the computer monitor), [Code/s: stimulated recall; gesture]
>
> *I was definitely using the tools, [Code/s: using visual manipulatives; tool use by individual; tool use within group work]
>
> *maybe I just didn't even realize that I was using it at all. [Code/s: intuitive tool use]

Finally, themes were culled from codes that were identified in the sum data. These themes grew out of all of the coded data turns that were then organized to create categories. Some of the coded turns in the example data above fell into one of the larger themes that eventually emerged from that sum data which was, "Tools mediating group discourse as visual manipulatives/stimuli for collaborative problem-solving."

Results

Simple material artifacts (block manipulatives and paper tools) seemed to both motivate and mediate problem-solving discourse because their particular affordances appealed to the particular problem-solving tasks in ways that more complex tools did not. We identified four dominant categories regarding how tools functioned with regards to the participants' collaborative problem-solving activities. Tools and representations mediated group discourse when they served as: 1) visual manipulatives/stimuli for collaborative problem-solving; 2) a means to explain an isomorphism between the tasks by highlighting correspondence between the constructible towers and the possible pizzas; 3) important elements for the successful employment of a particular learning strategy, process, or behavior; and 4) visual explanations or diagrams for formulated understandings or completed ideas. Although a variety of tools were identified throughout the condensed discourse data, two major material mediators were identified due to their high frequency in the data: blocks (concrete, manipulative tools) and paper tools. Analyses of select examples describing the three dominant categories of material mediation in the problem-solving discourse follow. The examples are ordered as chronologically as possible to chronicle the group's collaborative progress.

Visual Manipulatives

Blocks were used primarily in clips 1, 2, and 3 where the members of Group 5 worked on the first part of the problem: the block towers and pizza topping combinations problems. The group members began their investigations of the towers task by initially constructing as many towers as they possibly could. One strategy that they used to generate these towers was to form "opposite" towers to towers they already constructed: two towers were opposites if placed next to one another because they did not have the same colors at any level (e.g., the opposite of a blue-blue-yellow-blue tower would be a yellow-yellow-blue-yellow tower). In clip 3, it appeared that the blocks mediated the group's solution construction by serving as accessories in real-time, instrumental interaction. That is, the visual appearance of the blocks made forming opposites a natural strategy to employ.

It is interesting to note that the group members believed that the second task, the pizza problem, did not readily lend itself to a visual representation. Although the problems were isomorphic, the group members did not use a strategy analogous to the opposites one they used for the towers. For instance, students did not generate a new pizza from an existing one by including only the toppings that were not present on the other one. This observation is consistent with other students who worked on the pizzas and towers task (Powell, 2003). The opposites strategy may have been directly afforded by the blocks. In fact one student, Caitlin, indicated was not aware of how the blocks were influencing her problem-solving:

> Yeah, so maybe, you know maybe I was using them and not even realizing it (She is speaking while watching clip 3 on the computer)... Yeah, no that was probably definitely...'cause I mean, I can see from…from looking at this (watching the clip and pointing to herself on the computer monitor), I was definitely using the tools, maybe I just didn't even realize that I was using it at all.

Later, Caitlin tried to formulate an algebraic explanation to calculate the total number of block towers based on the number and type of blocks in each tower. As different members of the group introduced different bits of mathematical reasoning into the group discourse, Caitlin tried to direct the discourse towards the mathematical solution that she felt was at the heart of all of their suggestions. She tried to prove an exponential theory that was suggested by directing discourse towards finding a reason as to why a base of two (with an exponent that referred to the number of blocks in a tower, i.e., 2^4) happened to work when calculating combinations. She indicated that the base might have some connection to the two different colors of the blocks in the towers. During the collaborative discourse in this clip, Caitlin gestured and touched the blocks stacked on her desk:

> Caitlin: (gestures towards a block tower on her desk). Oh! Four *squared*. So, you're saying four squared…?
>
> Bob: So it's, it's squared, this is—
>
> Matt: You go over this…and I'm like, there is a reason.
>
> Liz: Yeah, because it's two, because you're using two. Alright, so when you square it, it's not so much the—

> Caitlin: But then when you had three cubes, it wasn't…three…squared…
>
> Matt and Caitlin (simultaneously): It was two to the third.
>
> Helen: Yeah, when you have three toppings—
>
> Caitlin: So—
>
> Helen: It's also—
>
> Matt: So the number of cubes is the exponent.
>
> Caitlin: Yeah…and then for this one the same (points to block tower). The two is the base…and n is the number of toppings. But we just don't know why it's two. Yeah, like, I mean it works out both ways but why is it two? I feel…you know what I mean, does two represent a color? Like, I don't know.

In this episode, the group attempted to determine which suggestions they made applied to the combination solution that they had formulated so far. They tried to connect their mathematical solution to the concrete artifacts both in their use of language (e.g., three cubes) to the exponent in 2^3 and their gestures. There is an important difference between how the blocks were used in the construction of towers and in this episode. In the construction of the towers, the blocks served two purposes: they represented members of the set of four-tall towers that could be produced, and they served as cues for producing new towers based on ones that were already produced. In this excerpt, the towers served the communicative purpose of objectifying abstract elements in the mathematical situation. Each of the four block locations represented a choice that could be made, and the two colors represented the number of choices.

Identifying Isomorphisms

In clip 2, the group tried to finalize a mathematical solution that would summarize the findings they had reached with regards to their block and pizza combinations. Some group members realized that 2^n n-tall towers could be formed with yellow and blue blocks and that 2^n pizzas could be created if there were n toppings to choose from. Caitlin, Bob, and Matt appeared to have at least a partial understanding of the algebraic formula behind the block and pizza problems, but Carla, Liz, and Helen had trouble grasping the connection between the algebraic formula and the blocks on the table in front of them. The group attempted to find isomorphisms that would link the surface representations of the blocks and pizzas together. In this way, they tried to transfer a connection across the problems and representations. For example, Matt used blocks to show Carla that there was an isomorphism between the sequence of colors in the block towers and the pizza topping combinations:

> Caitlin: So, is it, is it the same thing as this? (Gestures at the blocks on her desk).
>
> Matt: Yeah, it's, it's basically the same thing.
>
> Carla: No, it can't be because there are four different combinations. This is only two different combinations.
>
> Caitlin: No, it can't be.
>
> Matt: I know but, but like, each level represents a different topping, instead of (pauses, points to lowest level of a block tower) like this would represent, like let's say, sausage and this (points to next level up on same block tower) would represent pepperoni and like all the ones with blue on the bottom will have sausage on it, and all the ones without it—
>
> Carla: Oh, I get it. It would be easier if there were four different colors but I get it now.

Prior to this excerpt, a specific stack of four yellow or blue blocks represented a possible tower that could be constructed. In Caitlin's opening remarks, she raised the question as to whether such a stack of blocks could also represent a possible pizza. Matt answered affirmatively and explained how this could be done. Building this explanation required Matt to shift the way that he interpreted the particular tower. In the construction phase, the four blocks represented a *specific* tower, representing a member of the set of the 16 towers that could be constructed. Matt now treated the four blocks as an *abstract representation* of the towers. He appeared to ignore the actual colors in the stack of blocks, attending only to the position of the blocks. He described a general function that would map any 4-tall tower to a unique pizza.

Carla initially rejected the idea that there could be a mapping between the towers and the pizzas, because constructing the towers involved binary choices (yellow or blue) while building a pizza appeared to involve choosing amongst four options (peppers, pepperoni, onions, or sausage). This difficulty has been observed with other students working on the same problems (e.g., Powell, 2003). Carla appears to

believe that Matt's explanation resolved her difficulties. However, if the towers could be built from four different colors, the towers and pizza problems would not be isomorphic, and Matt's relationship would no longer hold.

Hence the blocks mediated the conversation in important ways. Caitlin's initial reference to the blocks focused the discussion on whether the blocks could represent a pizza as well as a tower. The blocks played a critical referential role when Matt was describing the mapping between the towers and the pizzas. Matt used the blocks to objectify the notion of the binary choice being made at each level and described how a similar binary choice was being made when deciding whether an individual topping should be placed on a pizza.

Tools/ Affordances for a Learning Strategy

Group 5's discussion in clip 5 centered on the nature of the blocks as potential affordances for a particular type of learning strategy. When clip 5 was recorded, the group had already worked on both the block and pizza problems and had watched a videocase where Brandon, a middle school student, explained how he had solved the same pizza problem using stacking blocks and a chart that he had constructed. The group discussed Brandon's use of blocks in the videocase and to what degree the blocks may have aided Brandon in solving the pizza problem:

> Bob: Are, are…do we need to break into this whole, um...about who gave him the blocks? Is that really—
>
> Matt: I mean…ya know...in the, in the book—
>
> Caitlin: The only reason why we were debating that was because we were trying to figure out, number one, although this may be difficult, we were trying to figure out, if he was a hands-on learner. Like maybe the block problem would be easier because if…it was a hands-on activity.

In this clip, Caitlin repeatedly asked both Cindy and her group whether Brandon was given the blocks or whether he asked for them in the videocase they had viewed. The group's discussion centered on understanding what role tools may have had in mediating Brandon's solution construction. If Brandon needed the blocks to figure out the solution to the pizza problem, then they felt that this would indicate that he was a visual learner and that tool mediation contributed a great deal to his solution of the problem. In pursuing this idea, their own discourse was mediated by the acknowledgment that tools may be necessary to significantly influence learning processes and strategies. In cultivating an appreciation for the effects of material mediation in the Brandon videocase, the group became more reflective about the role of tool mediation in their own learning.

Visual Explanations

Tools also functioned as reference, proof, or justification of the group's final solutions. In clip 6, Bob used a poster, which featured illustrations of several block tower combinations in red and blue and a pizza, as an explanatory tool to visually demonstrate the solutions the group had formulated through their collaborative problem-solving discourse:

> And likewise, when he went back to the um…block problem (gestures at the stacking blocks illustration), he was able to actually understand it further, because he used his information from the pizza problem (moves hand down to the pizza illustration) and said, 'Hey wait...this graph is just the same as these blocks (moves hand back up to the stacking blocks illustration)… So...ah, (reads verbatim from poster) number four, what activities did Brandon use to contribute to his learning…strategies? Ah...in his activities...included the use of tools. Um, (looks at the poster) pedagogical tools which are, ya know, he created a chart to organize his thoughts…So you can say that, the blocks (points to stacking blocks illustration) were actually ah...performance tools...and then um...and then the pedagogical tools which focus on...changing the user's competence ah, example, a stimulation designed to change the literate understanding of math, mathematical concepts…which was the pizza problem (moves hand down to point at the pizza illustration).

As Bob explained Group 5's understandings of the presentation proposal questions, he engaged with the tool in several ways: 1) reading from the poster; 2) gesturing at different aspects of the poster during his explanations; 3) touching the illustrations of the stacking blocks and the pizza; and 4) turning his head to address the student audience, but keeping his body turned and right hand outstretched towards the poster. The poster mediated Bob's performance and presentation as he looked to the poster for 1) a comprehensive account of the group's collaborative solutions, 2) a visual supplement that he could use to demonstrate the correspondence between the block and pizza problems, and 3) the order and delivery of this information to his audience. The poster also served as a supportive prop and visually clarified or reinforced appropriate points from Bob's explanation.

The group's poster is central to this portion of the clip; it mediated not only Bob's behavior, but also directed the visiting students' behavior and attention. The poster served as a benchmark, an indicator of what the group discussed and what solutions they agreed upon. At the same time, the representation served as a stepping-stone to the next level of problem-solving discourse. Hence, here we see what Gravemeijer (1999) would describe as a vertical shift, where a representation of a previous activity becomes an entity on which further mathematics can be done. The group did not have to go back over the material they had covered, except as referential information pertinent to new discussion. Using the poster, Bob was able to transform and re-present aspects of the group's problem-solving experience to create an objective explanatory experience for the visiting students. The existence of the poster mediated the framework of future collaboration in a chronological sense: it punctuated group discussion by serving both as an indicator of completed discussion topics and as stimulation for new discussion topics.

That the poster mediated Bob's performance is evident by his focus on the results of the group discourse, not on their process. When Bob read verbatim from the poster (or from a nearby textbook), he indicated that the information on the poster (as in the textbook) was of a finished, definitive nature: something that served as a reference rather than work in progress. In this way, Bob demonstrated that the group's problem solving had moved from processing to processed.

Discussion

Material Mediation and the Construction of Mathematical Meaning

Different material tools were used in a variety of ways to make or convey meaning in Group 5's knowledge-building process. The members of the group referred to the stacking blocks, paper posters, and technological resources in different ways, all of which indicated different levels of significance for the meaning-making properties each tool afforded.

We found that Group 5 used or referred to the following material mediators most during their problem-solving discourse and collaborative work: block tools (manipulatives) and paper tools. The block tools were used most frequently to mediate (in ranked order): 1) visual explanations of proposed solutions to the problems, 2) in-process, collaborative problem-solving, and 3) explanation of a correspondence across the bock and pizza problems. Paper tools were similarly used to mediate 1) visual explanations of proposed solutions to the problems and 2) in-process, collaborative problem-solving, but less frequently than the block tools.

This study illustrated how manipulatives may enable students to come to recognize important mathematical relationships through the use of tools. In mathematics education, instruction sometimes involves students interacting with manipulatives: physical tools that represent important mathematical relationships in a salient way. For example, the widely used Dienes base-ten blocks provide a physical representation of place value. However, the relationships that are salient in representations to those who are knowledgable of mathematics might not be obvious to someone who is still learning the mathematics (e.g., Cobb, Yackel, & Wood, 1992; Zazkis & Liljedahl, 2004). Indeed, without carefully designed instruction, some manipulatives may be instances of Bereiter's (1985) learning paradox, in the sense that one might need to already understand the mathematics represented in the manipulatives to interact with them in a meaningful way, which would inhibit their pedagogical value.

The blocks used in this study share these characteristics with the manipulatives described above. To someone who understands combinatorics, the physical appearance of a four-tall tower can provide insight into how many four-tall towers can possibly be built. Each of the four levels of the tower represents an independent binary choice. However, this was not obvious to the preservice teachers in this study, nor was it obvious to students who solved similar problems in other environments (Maher & Martino, 1996; Powell, 2003). It was only through the preservice teachers' interactions with the blocks that they were viewed more abstractly. How this process occurred is described in more detail below.

The block and paper tools most frequently served as visual explanations that illustrated the result(s) of the group's problem-solving processes. They also functioned as markers which indicated the current "level" of problem-solving discourse as well as encouraged relative, more complex levels of problem-solving discourse. When the group created a finished poster detailing the results of their collaboration, these paper tools often served as comprehensive, visual agreements as to the nature of the collaborative solution(s) the group advocated. Additionally, these tools indicated fruition in terms of collaboration: posters served as completed, definitive references that chronicled the results of these processes.

The block and paper tools functioned as catalysts for both starting and finishing group collaboration as well as in-process tools with which to collaboratively work through proposed solutions. The presence of the Unifix cubes or a particular poster during collaborative discussion was not only the start of many of the group's discussions, but often directed the conversations that

followed. Their language when they discussed the blocks with one another, their gestures when they referenced the blocks, and manner in which they handled the blocks during group collaboration indicated that the group both assumed and reinforced the connection they perceived between their formulative mathematical solutions and the concrete manipulatives. During such social knowledge-building intersections, the physical manipulatives supported group discourse. These manipulative turns within and during verbal discourse, in turn, mediated conversation to a point where the concrete arrangements of the blocks remained the focus of much group discourse thus mediating the group's solution process.

Finally, the group also used block and paper tools to indicate correspondence across the block and pizza problems. For example, the group built particular block tower formations as inspired by paper and pencil lists of pizza topping combinations. By using block and paper tools in these ways, the group not only connected the two problems, but also conveyed their underlying solution to the block tower combinations. The use of the blocks to explain the pizza problem established a correspondence across the problems and made the isomorphisms between them evident. The presence and use of block and paper tools during episodes of collaboration that discussed both problems helped the preservice teachers to establish what they already knew about the two problems, what was still necessary for them to figure out, and what connections were being revealed between the problems as they continued their problem-solving activities.

The Role of Tools and Artifacts in Constructing Solutions

The paper and block tools provided rich affordances for these preservice teachers for developing a solution to the mathematical problems. The tools' affordances included: 1) suitability to the creative nature of the task, 2) usability in terms of comfort levels and previous use of the tools by group members, and 3) availability during group collaboration.

The blocks and paper afforded the students different degrees of creative expression when they tried to explain proposed solutions to the rest of the group members quickly and in the heat of the discussion moment. For six people around a classroom table, it was convenient to gather around a large paper poster that afforded all group members visibility, access, and manipulation. The timely recording of the group's collaborative solutions was easily accessible to all members and may have empowered the group with regards to their group problem solving activities. Seeing a "tangible" list of what they had thought about or accomplished thus far on the group whiteboard may have given the participants the sense that they were making progress in terms of solving the problem. The block and paper tools mediated a discourse environment that worked like a creative rehearsal area where suggested solutions could be quickly and casually explored.

Second, students' past experiences may have also played a role in the choice of simple tools. The students may have gravitated towards these tools because of their conceptions regarding the suitability of particular tools to particular tasks (i.e., block tools are good for solving block problems, and paper tools are good for collaborative brainstorming or presentations). It is also likely that all members had some degree of mastery with such tools, using them in similar settings throughout their entire academic experiences. Thus, they were already familiar and comfortable with some of the affordances that these tools offered in collaborative settings. In addition, these tools may have equalized the participants' contributions to the discourse because their facilities in using simple tools like their hands and fingers (block tools) or a marker (paper tools) were likely quite comparable among group members and could promote group discourse.

Conclusion

These results contribute to a growing body of research demonstrating that simple material tools are important in mediating collaborative problem solving. Despite these important roles for tools and representations, their affordances may not necessarily be realized. How tools are used is determined not only by their mathematical affordances but also the student's past experiences with such tools (Katić, 2005). In this study, we illustrated how students' experiences with the Unifix cubes changed the way they used the cubes in their problem-solving activity. Students first used the tools to help investigate the problem situation. Later, the Unifix cubes, as well as the students' inscriptions, were later transformed into records that served to objectify their activity. We also suggest that providing preservice teachers with the opportunity to critically engage with interesting problems and tools to investigate the problem could be important for helping them understand their future students' tool-related thinking and activity. The prospective teachers in this study developed a meta-level appreciation of how a variety of knowledge-building tools and meaning-making modes could contribute to problem solving. This was illustrated when they discussed how Brandon was using Unifix cubes while watching a videotape of him solving combinatorics problems.

There appear to be several practical implications for teacher education instruction in higher education that can be gleaned from this study. First, students may

need to articulate their understandings of the nature and affordances of tool use within a problem-solving framework. Perhaps if teacher educators have a better understanding of how their students believe tools may affect their learning processes, they can create activities that deliberately engage their students in problem-solving activities that encourage expansion of both individual and group knowledge bases through collaborative tool use and experimentation. Simple tools, in addition to being affordable and uncomplicated additions to a classroom, may prove to engage students' collaborative problem-solving skills in ways that create potentially different and transformative learning experiences to compare and contrast to other experiences that already exist in their personal learning histories.

Preservice teachers used tools and representations in important ways to mediate their collaborative discourse as they both engaged in solving combinatorial problems and interpreting a child's reasoning about the same problem. Material tools provided a focus for students to negotiate their understanding and engage in social knowledge construction, thus serving an important mediational role. In other words, the material tools gave students something to talk about and focus on as they both built and represented their evolving understanding. Material mediation can provide support for learners engaged with complex ideas as they work together to build a shared understanding. Studies like this are important in understanding *how* material tools serve this key mediating function. Further work is needed to understand the kinds of experiences learners in general, and preservice teachers in particular, need to use tools and representations as effective mediators of their learning.

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What Does "Peer" Mean in Teaching Observation for the Professional Development of Higher Education Lecturers?

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The observation of teaching remains an integral process for the enhancement of practice as part of academic continuing professional development in higher education in the UK. This paper argues that failure to recognise the potential for peer-orientated development to reinforce restrictive norms of practice will be detrimental to the project of continuing professional development for learning and teaching. It is suggested that teaching observation schemes grounded in a peer model of observation within a reflective practitioner paradigm are potentially reinforcing parochial and performative constructions of teacher professionalism that ultimately enable resistance to changes to practice. It argues that for teaching observation to contribute to legitimate enhancement of teaching practice, such processes must be underpinned by pluralistic models of professional development that tolerate, and indeed require, critical differences of perspective that challenge rather than affirm the existing professional "self-concept" of experienced practitioners as it is enacted within current peer models of development in higher education.

The successful completion of an in-service postgraduate certificate in academic practice or higher education teaching has increasingly become, over the last decade, one of the standard expectations for confirmation of academic probation across the UK higher education sector. Yet it has been recognised that mid-career professionals may be far less likely to participate in comparable teaching-related continuing professional development activities (Martin & Double, 1998; Lueddeke, 2003). It has also been argued that, at different phases of their career, more experienced staff will value and benefit from different types of formal as well as informal professional development including practices of collegial mentoring, peer observation of teaching and collaboration with educational developers within work contexts (Ferman, 2002). Knight, Trowler and Tait (2006) have suggested that whilst accepting that learning can be promoted through event-based development activities such as formal postgraduate programmes or one-off workshops, "the problems of embedding that learning in the workplace are notorious." As such, professional learning can be better construed "as a consequence of situated social practices" (pp. 320–21). Hence, desirable enhancement of practice is more likely to be achieved in collective and collaborative ways when disciplinarily contextualised (Knight & Trowler, 2000; Clark et al., 2002).

The observation of teaching, when it is implemented in a formative context with disciplinary or non-disciplinary peers, is widely regarded as fulfilling the criteria necessary for the development of teaching practice individually and collectively across teaching teams, departments, and institutions. For example, Gosling (2005) has claimed that the discursive processes encapsulated within the experience of observation can be conceived of as a social practice that is both physically and intellectually situated within the practitioner's own workplace and discipline. Such approaches to teaching observation have increasingly been recognised as having a potentially transformative role in the enhancement of practice (Bell, 2001; Hendry & Dean, 2002) for higher education practitioners. By enacting the teaching of observation within an institution, it is maintained that the developmental outcomes for the individual teacher will contribute to the development of the wider teaching community when such individual development is widespread (McMahon, Barrett & O'Neill, 2007). Hammersley-Fletcher and Orsmond (2005), however, have argued that central to achieving this institution-wide quality enhancement are the mechanisms for the dissemination of best practice outcomes beyond the individual teacher. Yet research by Lomas and Kinchin (2006) has suggested that there is limited evidence for the successful propagation of enhanced practice across departments or institutions as a consequence of individual participation in teaching observation. The relationship between the individual and his or her peers then becomes a critical factor in achieving the outcomes of institutional enhancement practices.

This paper reports the outcomes of an evaluation of a teaching observation scheme for experienced academic staff introduced at a research-intensive UK university. In the context of an extensive published literature on teaching observations, the evaluation of a teaching observation scheme would not necessarily warrant further dissemination beyond the team responsible for implementation of the scheme. As such, this evaluative study was originally conceived with the view both to enhance the existing local processes and justify, at the policy level, the further embedding of the observation scheme within the institution. However, whilst the quantitative data derived from the evaluation

of the scheme provided strong evidence for participants' endorsement of the value of the observation process, the analysis of the qualitative data suggests that by accentuating the role of the peer within observation as an essential contributor to the effectiveness of the process, engagement in a peer-based model of developmental teaching observation potentially reinforces narrow, individualistic and parochial constructions of teacher professionalism that enable resistance to changes to practice. In interpreting the outcomes of the evaluation of the teaching observation scheme, this paper argues that the concept of the peer in teaching observation as the basis for individual, collegial, and cultural transformation and enhancement of practice in higher education should be problematised. The ways in which participants interpret and articulate the purpose of teaching observation itself and how they interact with others during the process of observation must also be understood as contributing to the fundamental "social character" of the observation process (Gosling, 2005, p. 9). Through an evaluation of participants' conceptualisation of the experience of observation, the potential limitations of the peer-based model of teaching observation implemented in this scheme are identified in relation to participants':

1. resistance to alternative critical discourses,
2. conceptualisation of insider/outsider status in relation to their discipline, and
3. understanding of professional identity as externally manifested rather than enacted as a way of being.

As such, the constructions of teacher developmental identity that participants reported in their evaluation of the teaching observation scheme are informed by an unproblematised conceptualisation of the peer observer as grounded in the realities of the lecturer's own world view and experience. This use of observation for the reinforcement of existing understandings of practice works counter to Ho's (2000) theories of professional learning whereby academic development seeks to change the conceptual basis upon which lecturers practice.

The Concept of the "Peer" in the Peer Observation of Teaching

If, as Donnelly (2007) has argued, the purpose of developmental peer observation of teaching is to identify, disseminate, and develop good practice, the act of developmental teaching observation, grounded in a reflective practitioner paradigm, is more frequently conceived in the literature as having profoundly individual-orientated outcomes whereby "consideration needs to be given to how feedback can contribute to a teacher's self-concept" (MacKinnon, 2001, p. 22). As such, intra- and interpersonal outcomes are often foregrounded in models of teaching observation. A positive teaching observation experience contributes to the reassurance and confidence-building of teaching staff (Blackwell & McLean, 1996), and the key aims of teaching observation include the development of interpersonal communication skills and the "personal skills of evaluation and self-appraisal" (Martin & Double, 1998, p. 162). In particular, Peel (2005) has acknowledged that the instrumental act of teaching observation alone is itself not contributory to enhanced teaching practice. In her understanding of the potential developmental outcomes of teaching observation, Peel has argued that the personal construction of the meaning of teaching observation and the capacity for self reflection are key factors in the construction of the "professional persona as an emergent practitioner" (p. 490) as an outcome of engagement in professional development activities. Traditional and still influential definitions of identity formation conceive of the self as constructed as an outcome of social interaction and the internalisation of social roles (Beijaard, Verloop & Vermunt, 2000). Yet whilst social interaction with a peer is widely advocated for making teaching observation meaningful, there is still limited research into how the teacher conceptualises the identity of a peer or how the interrelationship between this teacher self and a perceived "peer" within teaching observation can contribute to the developmental outcomes of the process for the professional teacher's self-image.

The concern that non-peer based teaching observation could function as an institutional mechanism of individual compliance (Shortland, 2004) and a simultaneous assertion of the discipline as the primary area of scholarly identification (Quinlan & Åkerlind, 2000) have reinforced the argument that enhancement activities are best implemented not at the institutional or cross-departmental level but within a peer context that acknowledges the disciplinary culture as the defining criteria for evaluating practice. However, if effective teaching observation facilitates the collegial development of a shared language about learning and teaching and contributes to the translation of teaching from a predominantly private to a public activity (Gosling, 2005), the socialisation of individual practitioners into a departmental conception of teacher professionalism brings with it the potential for the academic practitioner to understand both the practice of teaching and their professional "self-concept" exclusively and uncritically within a series of behavioural norms that are denoted in the concept of the "peer."

Gosling's (2002) influential theorising of different models of teaching observation is an example of how accentuating the social and situated aspects of

observation can, in practice, ultimately reconstruct observation as a socialising process that closes down multiple perspectives that are essential to "provide a language and conceptual framework to discuss teaching which goes beyond the accepted norms of the department" (Blackwell & McLean, 1996, p. 165). Within the three dominant models of teaching observation, Gosling has emphasised the term "peer" as a central concept for understanding the development potential of observation. For Gosling, the identity of observer and lecturer are essential in distinguishing between the social and political context of an evaluative or appraisal-orientated model, in which differences of perspective are asserted and potentially "bias the judgement," a developmental model, in which the observer "occupies the role of the expert – although still a peer", and the peer review model, in which "there is real mutuality and respect for each of the participants as equal" (p. 2). Concurrent with this defining of the peer as an unbiased, social and professional equal is the notion that it is out of the "self and mutual reflection" inherent in genuine peer-based observation that the enhancement of teaching practice is realised (Gosling, 2002, p. 5). In this context, therefore, the concept of peer within the processes of observation and reflection constitutes a necessary sameness ("mutuality") between the beliefs, values, and experiences of individuals that is essential for the developmental potential of teaching observation: "There is not a clear distinction between the one who is the developer and the one being developed" (Gosling, 2005, p. 13). In part, this recognises the potential for development to accrue to both observer and lecturer during the processes of observation, as Cosh (1998) has argued. Yet it also commends a sameness of perspective and experience that can have a potentially limiting effect on the genuine transformative outcomes of teaching observation practice.

Whilst Gosling has warned that there is a potential for limited definitions of who constitutes a peer to sustain narrow conceptions of practitioner identity and reinforce the existing values and cultural context of peers, his categorisation of models of teaching observation emphasises precisely that narrowing of the definition of peers. The relationship between the individual and the community within the university, as it is enacted in the relationship between observer and lecturer across Gosling's three models, is located along a continuum from "power" (evaluation model), to "expertise" (developmental model) to "equality/mutuality" (peer review/collaborative model) (Gosling, 2002, p. 5) that arguably stigmatises difference of status and perspective as an articulation of observer bias or authoritarianism and lauds sameness as the inevitable expression of a liberal and non-judgmental perspective on teaching practice. The danger of this assumption is that this tacitly inverts the traditional politics of the reflective self. Such a conceptual sleight of hand can only further problematise strategies aimed at integrating the individual outcomes of teaching observation into the "depersonalized" debates at School and institution level necessary for the broader enhancement of learning and teaching in higher education (Hammersley-Fletcher & Orsmond, 2004, p. 502). It is this fundamental imperative to explore the definition of "peer" that underpins the evaluation of the scheme reported in this paper.

Implementing a Teaching Observation Scheme for Professional Development

A teaching observation scheme was introduced in a research-intensive, pre-1992 higher education institution as a key component of an emerging institutional continuing professional development framework. Engagement in the observation scheme was by self-nomination, and participation did not contribute to formal staff appraisal strategies. In the design of the observation scheme, following a review of the literature on teaching observation and of existing practice within the institution by the author, a model of teaching observation, derived principally from the work of Bell (2001) and Fullerton (2003), was adopted whereby participants completed three teaching observation cycles and a final reflective account of their teaching and observation experience at the end of the observation process. The model adopted facilitated the inclusion of two observers across three observations (two observations were completed by a lecturer from the central academic development unit and a third observation by a disciplinary colleague) that provided both a multidisciplinary, pedagogically-informed (educationalist) and disciplinary (colleague) perspective on practice. The model, therefore, represented a hybrid version of Gosling's developmental and peer review/collaborative models with the weighting on observations by an observer not working within the lecturer's department (Gosling, 2002). This hybrid model enabled the expert identification of pedagogic practice and facilitation of reflection as well as disciplinary feedback, and hence accentuated a broader definition of peer beyond a traditional disciplinary meaning.

The final reflective overview completed by the participant was planned to reinforce the self-reflective rather than evaluative orientation of the teaching observation scheme as described in Bell's (2001) study. In the first year of the scheme, the final overview constituted a reflection on the feedback provided across the three observations for the purposes of demonstrating the best practice of the individual. This

was later modified in response to negative participant feedback, and participants were asked to independently complete a fourth self-observation in the light of the prior three observations and their own reflection on their feedback. As such, the teaching observation scheme was rooted in a widely-accepted professional development model of facilitated and individual reflective practice.

The observation scheme was implemented as a stand-alone activity to mirror an existing teaching observation process within a postgraduate certificate in academic practice for new academic teaching staff and to complement an institution-wide peer review of teaching process which operated on an annual or biennial basis within each disciplinary-based School. The observation scheme specifically targeted those staff who had not participated in a formal teaching development programme, and the broad demographic of participants constituted senior lecturers, professors, and, within the medical education context, consultants. Ultimately, the scheme also proved flexible to the needs of less experienced part-time teaching staff and, in particular, clinical teachers. Observers from the central academic unit were of a comparable professional status to the participants. Disciplinary peer observation practices similarly paired lecturers with broadly equivalent levels of experience. All participants were volunteers and as such were deemed to be seeking constructive feedback on their teaching practice for the purpose of enhancement and recognition.

Initially, 56 academic teaching staff from across all discipline areas within the institution registered to participate in the scheme. The three observations could be completed over an 18 month period, though in practice many participants completed the observations over a single semester. The observations themselves followed a sector-wide standard structure of pre-observation discussion, observation, and post-observation discussion with each stage recorded in an observation report written by the observer. Observations would in general take one to two hours with half-hour pre- and post-observation discussion. Pre- and post-observation discussions were responsive to the specific context of the observed lecturer and the observed session. However, participants and observers were guided to structure their discussion in relation to four areas of practice: teaching strategies and session management; subject knowledge and subject application; assessment, evaluation and monitoring; and professional knowledge and development. Excepting pre- and post-observation meetings, no further formal tutorial support was provided for within the scheme.

Evaluating Teaching Observation for Continuing Professional Development

The primary aim of the evaluation was to determine how participants perceived the teaching observation scheme and how they conceived its contribution to their professional development. Whilst it is acknowledged that a survey method can generate unsophisticated data that is limited in scope (Cohen, Manion & Morrison, 2000), a questionnaire was chosen as the most likely tool to elicit sufficient responses to evaluate the appropriateness of the observation process from senior academic staff with considerable pressures on their time. A combined quantitative and qualitative questionnaire was developed based upon the questionnaire items used in previous studies seeking to determine perceptions of teaching observation by Cosser (1998) and Hatzipanagos and Lygo-Baker (2006).

The quantitative element of the questionnaire asked participants to rate the value of the separate aspects of the observation process (pre-observation, observation, post-observation, disciplinary observation, and final reflective process). The qualitative element of the questionnaire posed open-ended questions relating to their experience of teaching observation, for example, “What is your view of the teaching observation process?” and “What characteristics make for an effective observer?” Subsequent questions asked participants to comment on the outcomes of their participation in the teaching observation scheme, for example “In what ways has your experience of participating in the teaching observation process impacted on your practice?” and “Has the teaching observation process been developmental?” The questionnaire was distributed to 37 academic staff that completed the teaching observation scheme within the two-year period of the evaluation, and 21 participants returned completed questionnaires. Of the 21 respondents, 12 were female and 9 male and were working in general medicine, dental education or psychiatric medicine (6), nursing and midwifery (4), experimental sciences and engineering (4), humanities (3), and in math, computer science, law or management (4). The following discussion is based on the qualitative data collected using the questionnaire.

Participant responses to the open-ended questions were analysed by the author to identify and interpret common themes in participants’ descriptions of their experience of teaching observation and their perception of the impact of the teaching observation process on their practice. Three distinct categories emerged from the clustering of the dominant themes: the participants’ perception of the nature of critical discourse, the

situated nature of professional practice, and conceptions of professional development. As the lead academic responsible for the implementation of the observation scheme in the institution as well as an active observer, the analysis of the data was undertaken as a participant-researcher. Despite the need to remain sensitive to the values and assumptions such a perspective can bring to the analysis of the evaluation data, the insider status within the scheme also leads to insights into the specific context within which participants frame their relationship to their communities of practice and to the experience of observation. However, to offset the limitations of the data collection method and assert the validity of the categories developed through the analysis, extensive illustrative quotations from the evaluative data are included in the following descriptions of each of the three categories.

The Nature of the Critical Discourse of Teaching: The "Academic Jargon of Pedagogy"

The category relating to the nature of critical discourse identified the themes of critical dialogue, verbal accounts of experience, and the perception of pedagogic "jargon." This category reflects how respondents perceived the role of feedback as it informed their understanding of their teaching practice, the ways in which they found the observation process enabled them to articulate previously undisclosed interpretations of their teaching and the negative characterisation of the widespread language of learning and teaching development.

In describing their experience of the observation process, a number of respondents identified the centrality of participation in critical dialogue to aid their understanding of their practice:

> "[observers should] ask challenging questions of experienced teachers about their practice" (R1).

> "the observations (and related discussions) were an extremely effective learning process for me" (R9).

> "discussions being supportive and exploratory" (R14).

The value respondents placed on engaging in critical discussion with disciplinary colleagues varied so that whilst some respondents found such discussion informed their practice, with personal affinity between observer and lecturer valued, for others the relationships between colleagues prohibited desired levels of criticality:

> "comments from colleagues influence how my teaching can get better" (R3).

> "has the potential to elicit real insights in the teacher if there is a good rapport between teacher and observer" (R21).

> "it can be difficult for known colleagues to give critical feedback if appropriate" (R14).

As an outcome of participation in reflective dialogue, several respondents commented on specific changes to the way they were able to express what they were doing in their practice:

> "I was able to see the real value of some of the things I was doing instinctively in more analytic terms" (R6).

> "[the observer] can elicit what it is the observed is trying to do, even when the observed might not have ever clearly articulated it!" (R9).

Yet despite seeing the value of critical discussion, for many respondents the possibility of engaging with pedagogic discourse distanced them from their "real" experiences. This was a particularly rich theme in this category as respondents emphasised their need for an observer to "not use pedagogical jargon but real language" (R4) when discussing practice:

> "The academic jargon of pedagogy is often jarring and does not reflect practice in the way it is experienced" (R3).

> "thought it would be just a jargon ridden 'talking-shop' […] I feared it would be something for show, rather than being actually useful" (R9).

> "engage with the teacher in non-technical language about what they are doing in class […] I at no point felt the victim of a doctrinaire approach to best practice, or non-discipline relevant orthodoxy. This has not always been the case in my earlier experiences of teaching support" (R6).

However, despite the positive experience of the observation discussions, the requirement to complete a self-reflection on the teaching observations led this last respondent to comment that this reflective process:

> "required me to translate into jargon the real experiences which had been so beneficial [and] made abstractions necessary of whose validity I was not convinced" (R6).

The importance of developing a critical discourse of professional practice in higher education is posited by Rowland (2001), and, as the positive response to

participation in discussion in the data cited above demonstrates, the primacy of discursive practices within teaching observation provides opportunities for practitioners to articulate their teaching acts in new ways. As Gosling (2005) has argued, the challenge in bringing private acts of teaching into a public domain is that the language available for describing teaching practice has become impoverished and respondents indicated that participation in observation discussion facilitated the articulation of experiences in critical ways ("insight", "analytic terms"). Yet the repeated distinction by participants between their sense of the "real" experiences and the language used to express this through reflection reasserts the need, as Clegg, Tan and Saeidi (2002) have suggested, to problematise the assumption of a straightforward relationship between reflecting and acting within professional development.

Whilst the process of discussion with the observer provided the lecturers with opportunities to "see" their practice from new perspectives, the emphatic resistance to the "jargon" of pedagogy by a number of respondents and its perceived lack of application to the reality of their teaching evidences a continued conceptual hiatus between the teaching experience and its verbalisation during teaching observation. The assumption that "non-technical language" can capture, in unmediated ways, the reality of the teaching experience expresses a problematic certainty that such "non-technical language" for describing personal values, theories, and acts has common meaning within a practitioner's community (Griffiths & Tann, 1992). In essence, there is an assumption that peer-to-peer discussion can be framed in plain language because each discussant understands the language in identical ways. In such a context, jargon is the language of the "other" from outside the peer community and as such is disregarded as a language that is meaningless because detached from the "real experience" of practice.

The repeated assertion by respondents that pedagogic language distances them from the experience implicitly articulates a resistance to alternative discourses operating outside the familiar, "real" world experiences of the lecturer as actor in the teaching context. It expresses a common-sense assumption about the nature of teaching itself, of teaching as acts that can be expressed through a commonly-shared language of peers. To characterise the participation in alternative discourses as an act of translation into a new language is to demarcate explicit boundaries of knowledge and acting that resist the critical turn reliant on "the critical deployment of multiple discourses […] integrating critical reason, self and action" (Barnett, 1997, p. 137). By diminishing the possibility of "jargon" to express experiences of reality, the lecturer can retain the distinction between the theories and the practice of teaching whilst closing down the possibility to act as the "interpreter of new discourses" (Barnett, 1997, p. 142) requisite to fulfil Barnett's concept of critical professionalism. The individual and collective implications of such discursive conservatism are the reinforcement of the lecturer's existing knowledge of "self-concept" and the social groupings within which "real" experience is enacted and interpreted by discipline and department peers. By implication, to articulate experiences in a different way and to possess a different world view is to transgress the bounds of the "real" world. To be a peer is therefore to experience the world in the same way as a reality and to be able to express that reality through a shared language.

The Situated Nature of Observed Professional Practice: The "Outside Observer"

The category of the situated nature of professional practice related to the themes of situated problem-solving, the concept of the "outsider" perspective, and examples of change as instrumental rather than conceptual enhancement.

For many respondents the primary rationale for teaching observation was essentially perceived to be remedial and not only derived from, but bound into, the actual specific observed teaching. For these respondents, observation-based development, therefore, had a fundamentally situated problem-solving role that respondents did not explicitly see as more broadly applicable in other contexts:

> "I think it would be helpful to call in an observer at a particular juncture – e.g. if a course seemed to not be doing well, or if one was launching a new course […] it would be hard to recommend it regardless of such circumstances" (R 4).

> "it would help to show up bad habits" (R11).

> "to see what works in a given situation, rather than start from preconceived ideas" (R17).

Within this problem-solving orientation, respondents were undecided about how to manage and value both disciplinary and "sympathetic outsider" (R9) perspectives. Whilst a number of participants believed it important that observers were from a cognate discipline, others valued the "outside" perspective which "can provide a more fundamental view" (R11) of their "inside" contextualised practice. In characterising the desired attributes of an observer, respondents suggested:

> "Neutrality, preferred 'outside' observer to in-house as I believe it is easier for them to be objective and honest in their feedback" (R10).

> "Familiarity with teaching and teaching techniques and preferably some understanding of the subject matter. For the former an 'outside' observer may be in a better position to offer new ideas, but if these are unconstrained by the latter they […] are often impractical" (R13).

> "All disciplines can become focused on particular issues or gravitate towards similar teaching styles/expectations so having time to reflect with people outside of the School was useful" (R14).

When describing how engagement in the observation process had or can better impact on their practice, respondents characterised this development in instrumental rather than conceptual terms. Whilst recognising that impact could be manifested in both a "diffuse way" and "specific way" (R12), the examples respondents gave of their perceived change are principally related to changes in teaching methods within specific contexts:

> "I picked up a lot of useful tips in terms of slide organization, amount of info on slides etc." (R18).

> "As far as teaching goes, I think my needs are likely to be technical as much as anything" (R17).

> "A system of providing 'tips' on how to improve teaching, deal with specific situations etc. may be of more widespread interest. Such a scheme would dilute the theoretical component" (R3).

The situated nature of teaching observation is considered one of its strengths for the development of practice, and the positive responses of participants to the feedback they received support the perceived value of observation for effecting changes. The repeated characterisation of "inside" and "outside" observers for a number of participants highlights this conceptualisation of practice as both a physically and epistemologically located activity. Whilst several participants had expressed discomfort with the non-native language of pedagogy, other participants clearly saw potential value in gaining alternative perspectives on their practice. Yet the repeated conceptualisation by these participants of their practice identities as "inside" subjects exposed to "outside" interpretation demonstrates that, despite openness to alternative views for some respondents, there is a distinction between a situated notion of practice and an external theorisation of that practice. In characterising the non-disciplinary observer as capable of giving "objective" feedback from a position of "neutrality" whilst retaining the need to resist feedback that is "unconstrained" by "familiarity" with the values of the discipline, these respondents articulate very precise notions of the relationship between observer and lecturer as peers.

The metaphor of insider and outsider articulates in a powerful way a fear of the "other" at the heart of the experience of teaching observation, as Kinchin (2005) has found. Rather than demonstrating the benefits of interdisciplinarity observed in other teaching observation models (Donnelly, 2007), this evaluation identified an explicit labelling of, and resistance to, different disciplinary perspectives. A number of competing concepts, including objectivity ("neutrality"), domesticity ("familiarity"), and containment ("unconstrained"), surround the attempts by these respondents to explain the experience of negotiating the "other" in the teaching observation context. So whilst there is a broadly positive response to the opportunity to engage an "outsider" in the review of practice, the experience provokes profound concerns about what Palmer has described as the nature of a "live encounter" with the "other" that might "threaten our view of world or self" (as cited in Kinchin, 2005). The perception of the situated nature of practice within teaching observation facilitates a self-protective approach to this encounter by ensuring that the normative safety of the discipline is regarded as the *a priori* basis for all feedback on practice as an outcome of teaching observation. The usefulness or impracticality of outside observer feedback is always determined in its relation to the accepted values and discourses of the respondent's discipline.

Conceptions of Professional Development: "Surely That Also Counts as Development"

The category of conceptions of professional development related to the personal issues of self-esteem or reassurance and respondents' perception of the scope of professional development for learning and teaching.

For a number of respondents the principal outcome of the observation experience related to confidence-building as practitioners. In most cases, such confidence was allied to the perceived approval of their existing practice rather than the confidence to explore new conceptions of practice with only vague ideas about future development:

> "gives confidence and affirmation of what one does well; gives focus for development" (R7).

> "The feedback was positive so this provides confidence that approaches used in my teaching is on track" (R14).

> "I am sure it will lead to some changes in my approach, but also strengthening my confidence in

> the things I already do – and surely that also counts as development" (R17).

A number of respondents viewed the observation scheme as contributing to their enhancement of practice, frequently using construction metaphors to conceptualise their professional development as an externally-manifested "process" (R1) of building upon prior experience:

> "There is always scope for improvement, an improved understanding of the process of student learning" (R3).
>
> "as the observations continued I built upon the post observation discussion modifying the way I taught at each stage" (R19).
>
> "built upon previous observations and comments and I will use the experience to develop my teaching practice" (R20).
>
> "make more use of some elements of my teaching that the observer found especially effective, and to think of how I might build on them" (R6).

Whilst the observations evidently fulfilled the interpersonal objectives of many respondents in terms of confidence-building and reassurance of their approach as practitioners, the ways in which participants undertaking the observations understand the nature of their development distinguish between professional development as a constructive incorporation of new ideas into existing practice and professional development as a transformative act that reconfigures the nature of the professional being itself. The recurrent metaphor of development as building in a number of respondents' comments expresses an understanding of enhancement strategies as cumulative in effect. Framed in this way, engagement in teaching observation is for the purposes of identifying the strongest foundations of current observed practice as the basis for either the modification or the addition of improved practices. When linked to the dominant outcomes of personal and professional reassurance and affirmation, the expectations for professional development are not radical but progressive, an outcome that is certainly not illaudable.

Yet the danger is that there is an underlying implication that such an approach to developmental teaching observation is the expression of a behavioural competence model of reflective practice. In holding up a mirror to practice through observation, the practitioner can see where improvement can be made and receive rewards for "what one does well." Betts (2004) has argued that this notion of developing "good" practice through reflection operates on the basis that there is already a model of best practice to be fulfilled so that if the reflected professional persona is "not in line with the model, then practices must be adopted which allow (or ensure) closer resemblance to the desired figure" (p. 242). As such, reflective practices facilitated through teaching observation have a normative function whereby the socialising orientation of the observation process attaches notions of moral "goodness" to the acceptable performance of attitudes and actions as they fit with a shared model of professionalism. As Betts has warned, such an approach, whilst appearing to demonstrate visible results, can be a way of non-engagement, a way of fulfilling external notions of "good" behaviour whilst remaining detached from this performed identity. In configuring teacher development as a building project, it is possible to construct a notion of the teaching and reflecting self that is observable by one's peers, yet potentially lacking in critical awareness beyond this conformity to a public identity. As Mackenzie, McShane and Wilcox (2007) have suggested,

> Performativity and authenticity signify different levels of identity in the conscious experience of the self. The performative self is a fabricated, socially constructed self, created and confined by our respective social and institutional laws and rules. Authenticity refers to an inner self that can recognise performative demands and act knowingly and mindfully in response to them. (p. 42)

In perceiving the matching of the model in the mirror as the appropriate outcome for engagement in teaching observation, the conceptualising of development as building reaffirms the respondents' expectations of mutuality between practitioner and observer as socialised and socialising professional peers agreeing to participate in a reciprocal performance of their respective professional identities.

The complicity with a performative notion of the professional self and its development in the responses of a number of respondents is put into starker contrast when compared to a potentially more authentic conceptualising of the self. One respondent when asked to explain her perceptions of the observation process expressed a conceptually broader understanding of her professional development. For this respondent, the experience of observation facilitated a development from problem-orientated aims at the beginning of the process linked to a performative conception of professionalism (for example, the identification of "shortcomings") to a subsequent reconfiguring of her thinking about teaching practice as a fulfilling of a specific teaching role (for example, what it means to be a "clinical teacher"):

> "I volunteered for the pilot scheme as I wanted to know for myself how well I was doing as a teacher and what my shortcomings were. The observation process has given me an insight into how best I can fulfil the role of a clinical teacher" (R16).

This shift from notions of acceptable acts of "goodness" as a teacher to a thoughtful awareness and reflective account of the demands of her professional role demonstrates a distinctive alteration of perception of an authentic self within a community of peers. Emerging from this respondent's engagement in the observation process is a perception of professional development not simply as a cumulative acquisition of peer-approved teaching skills to be performed, but an integrative and transformative new "way of being" (Dall'Alba, 2007, p. 686) as a clinical teacher who operates knowingly within the social values and structures of her professional peers.

Conclusion

The centrality of the professional "self-concept" in the development of teaching practitioners in higher education is widely recognised. The perception held by practitioners of their professional "self" and its relationship to the values, beliefs, and discourses of peers can have profound implications for the ways in which any development is enacted and embedded. As such, within the processes of teaching observation, the professional "self-concept" is intimately allied to the practitioner's conception of the "peer," whereby there is no distinction between the one being developed and the one facilitating that development.

In evaluating a scheme of stand-alone developmental teaching observation for experienced academic staff, the identification of participants' perceptions of pedagogic "jargon" and its relationship to "real" experience, of insider and outsider theories of academic identity, and of models of professionalism as performative fabrication convey fundamental assumptions about the role of the peer in the academic development context. As Palmer (1998) has argued, such abstractions of self and peer within teaching act as mechanisms aimed at foreclosing the possibility of a "live encounter" with the "other" (p. 37). Arguably, such resistance to the "live encounter," with others or even with dissenting voices within the self, limits the possibility of an alternative view of professional identity as a "way of being."

A conservative definition of "peer" as socially and intellectually normative has consequences for the defining of the "self-concept" of the practitioner through teaching observation. Fear of exposing practice to alternative values, language, and acts expresses fear of the loss of identity, to "risk losing our sense of self" (Palmer, 1998, p. 38). As such, failure to explore and challenge participants' construction of the peer within developmental teaching observation perpetuates the self-protective urge to fabricate a performative understanding of professional identity and its development under the guise of engaging with "real experience." For teaching observation to contribute to legitimate enhancement of teaching practice, such processes must be underpinned by pluralistic models of professional development that tolerate, and indeed require, critical differences of perspective that challenge rather than affirm the existing professional "self-concept" of experienced practitioners. This paper has suggested that, from an analysis of evaluative questionnaire data, existing traditional models of peer-based teaching development are epistemologically and ontologically limiting, and that these models warrant further qualitative inquiry to appraise the ways in which the identity of the peer is constructed and reinforced within established developmental mechanisms and how the ways in which "peer" is understood profoundly influence the construction of a developing practitioner's professional "self-concept" within enhancement practices.

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An Experimental Evaluation of the Instructional Effectiveness of a Student Response System: A Comparison with Constructed Overt Responding

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Student response systems (SRSs) are increasingly being used in the classroom. However, there have been few well-controlled experimental evaluations to determine whether students benefit academically from these instructional tools. Additionally, comparisons of SRS with other interactive methods have not often been conducted. We compared SRS, Constructed Overt Response (COR), passive, and control conditions to determine their effects on learning and affect. We found that students performed better in the interactive conditions—SRS and COR—than the other conditions. Participants' gain and retention of gain scores in the SRS condition were lower than those in the COR condition. Participants in the SRS condition perceived their condition as more enjoyable than those in the passive condition and more useful than those in the control condition. Additional research questions are raised about how these interactive methods may best improve student learning.

Active learning approaches in the classroom have long been recognized as a means of promoting student acquisition of course material (Hake, 1998; Kritch, Bostow, & Dedrick, 1995; Pratton & Hales, 1986; Sivan, Leung, Woon, & Kember, 2000; Yoder & Hochevar, 2005). Teaching methods that involve student exchanges with peers, instructors, or others about the learning material – termed interactive teaching – can facilitate acquisition and retention of course material (Bonwell & Eison, 1991; Brophy, 1986; McKeachie, 2002; Sokoloff & Thornton, 1997).

An interactive teaching technique well-suited to large class sizes is the use of a student response system (SRS). With this method the instructor intermittently poses questions embedded in presentation software (e.g., PowerPoint) projected onto a screen during ongoing classroom instruction (see Banks, 2006 for more information). Students answer questions by pressing buttons on a remote response device (RRD) to transmit their encoded answers to a receiver connected to the instructor's computer. When polling is completed, the instructor advances to the next slide to display a histogram of the class responses. The data are reviewed with the class and may result in additional instruction and discussion. Student response data are saved and available for off-line analysis. Since each RRD has a unique code, the students' response data can also be used for recording attendance or tracking individual progress. Course points can be awarded based on this response data (Burnstein & Lederman, 2001).

SRSs provide an easy-to-use means of collecting student information in real-time, which may enhance the classroom environment in various ways (Collins, 2007). SRSs place students in an interactive role (Cutts, Kennedy, Mitchell, & Drapper, 2004; d'Inverno, Davis, & White, 2003; Fries & Marshall, 2006). Siau, Sheng, and Nah (2006) demonstrated that significantly greater student communication and engagement occurred following use of SRS. The active responding and immediate feedback to questions posed by the instructor may hone students' comprehension of the material, leading to greater learning (Dufresne, Gerace, Leonard, Mestre, & Wenk, 1996; Forsyth & Archer, 1997).

Topics may be broached by administering SRS opinion polling to pique student interest in the course material and gain insight into their position on controversial or sensitive issues. Because answers are provided anonymously, a more accurate measure of attitude and understanding may be obtained, and students may be less reluctant to participate in the classroom (Davis, 2003).

SRSs are not devoid of negative aspects. Instructor time is needed, both to become proficient with the computer hardware and software and to prepare challenging questions. Class time is also required for presenting questions, reviewing the histogram, and providing remediation. Technical problems can occur with these systems which may result in lost data or delay of class presentation. Additionally, the cost of purchasing the RRD (approximately $20-$40 U.S.) may be too burdensome for some students.

Given the possible advantages and disadvantages associated with SRSs, it is important to empirically address whether they are effective instructional tools. Although many studies have found that students prefer using SRSs in the classroom compared to traditional methods of instruction (Littauer, 1972; Siau et al., 2006; Teeter, Madsen, Hughes, & Eagar, 2007; Trees & Jackson, 2007), research results concerning the effect of SRSs on student performance are mixed.

Pemberton, Borrego, and Cohen (2006) compared a LearnStar® student response system to a traditional

review method with 378 undergraduate students. Condition assignment was determined by course schedules for the six classes that participated. Although no significant differences in test scores between conditions were found, students reported higher enjoyment and participation in the SRS condition compared to the traditional instruction condition.

Paschal (2002) also compared a traditional approach (class lectures and graded homework assignments) to lectures intermixed with SRS-delivered questions. Using a quasi-experimental research design, 132 students participated across two years in either the traditional instruction (during first year) or SRS (during second year) conditions. No significant differences in student course performance between conditions were found, although students perceived that use of the SRS contributed to their learning and time management.

Using an earlier SRS prototype, Brown (1972) compared traditional instruction to SRS conditions when teaching mathematics to first year college students. Test scores, anxiety levels, and attitude toward mathematics were not significantly different between conditions for the 73 students who participated in this experiment.

Some studies suggest that use of SRS may improve test scores. Using an AB design, Bullock et al. (2002) found 200 undergraduate students improved their attendance, participation, homework completion, and exam performance after a SRS was implemented as compared to when a traditional approach was used. Kennedy and Cutts (2005) found a significant positive association between students' use of SRSs and exam performance.

Considering that SRSs have been in use in classrooms since the 1970s, it is remarkable that relatively few well-controlled experiments have been conducted to determine their instructional effectiveness (see Fies & Marshall, 2006 for a review). Moreover, much of the past research has been conducted in the field. Although classroom research increases the generalizability of the findings, less control over confounding variables can make interpretation of the data difficult (e.g., order and difficulty of material, participant characteristics, instructor bias).

Another weakness with the past research evaluating SRSs involves the type of control/comparison condition used. In past research (e.g., Pemberton et al., 2006), SRSs were compared to a traditional instructional style which, in general, is a passive method involving little student-teacher or student-peer interaction. A comparison of SRS with a traditional method of instruction does not address whether more interactive approaches are equally or more effective.

Another interactive teaching method that fosters participation by all students in the classroom involves the use of response cards (RC). In one form of this approach, each student is given a set of cards with which to answer questions during the class. These cards display letters (e.g., A, B, C, D) for answers to multiple-choice questions or other response indicators as determined by the question format (e.g., true/false). The teacher poses a question to the class, and each student holds up the appropriate response card. The teacher then surveys the students' answers and provides remediation or continues instruction as necessary (Gardner, Heward, & Grossi, 1994). Marmolejo, Wilder, and Bradley (2004) compared RC to hand-raising with 27 psychology majors in a learning course. These researchers found that most students performed better on quizzes and participated more in class when RC was employed.

Another form of the RC method is constructed overt responding (COR) (Narayan, Heward, Gardner, Courson, & Omness, 1990). With this method the student writes an answer to a question posed by the instructor on a card, sheet of paper, or dry erase board. When requested to do so, all students hold up their answers or call out an answer (choral responding) for the instructor's review. The results of research evaluating this method are similar to the use of response cards. On average, when students used COR they performed better on quizzes, their frequency of active response increased, and they preferred response cards compared to answering in-class questions by hand-raising (Davis & O'Neill, 2004; Gardner, Heward, & Grossi, 1994; Narayan et al., 1990) or passive review (Cavanaugh, Heward, & Donelson, 1996). Although most of these studies involved elementary or high school students (e.g., Cavanaugh et al., 1996; Davis & O'Neill, 2004; Lee-Vieira, Mayer, & Cameron, 2006; Narayan et al., 1990), greater gains in a constructed response condition compared to passive conditions have also been found with college students using computer-based instructional software (Thomas & Bostow, 1991).

Requiring students to write or vocalize a correct answer to questions posed during a lesson may enhance student learning and retention of the information when compared to simply raising a letter to signify the correct answer. The COR method involves recall of the answer rather than merely recognizing or discriminating the correct answer from other items on a list, as is the case with a multiple-choice format, which may facilitate learning (Edwards & Arthur, 2007). By writing the correct answer rather than selecting a letter corresponding to that answer from a list, the student practices the desired behavior. Alba and Pennypacker (1972) compared two different types of study sessions: one in which students orally answered fill-in-the blank questions (COR) to another in which students completed individual projects. These researchers found that gain scores (post-test minus pretest scores) were

significantly higher for participants in the COR condition compared to the individual project condition.

There have been a few studies that have compared SRS to other interactive instructional approaches. Stowell and Neilson (2007) compared SRS to RC and other traditional methods (i.e., standard lecture and polling via hand-raising) with 140 undergraduate psychology students and found no difference in performance on a post-test. Using a subjective evaluation instrument, the researchers found slightly higher enjoyment ratings for those participants in the SRS condition. Additionally, Lasry (2008), using Mazur's peer instruction approach (see Couch & Mazur, 2001), experimentally compared SRS to flashcard methods of answering questions in class. There were no learning differences between participants' scores in the two groups found in this study.

Given the increasing use of technology in classrooms in countries such as the United States and Canada, it is important to experimentally determine whether use of SRS enhances students' acquisition of instructional material. In this study we compared SRS, COR, passive, and control conditions to determine their effects on acquisition and retention of instructional material, and student preference.

Method

Participants

Eighty-four students from an introductory psychology course at a medium-size, liberal arts college in New York State participated. Participants received research credit for voluntarily participating in the study (a standard practice in colleges in the United States). There were 20 students with an average age of 19 years in the SRS condition – 13 females and 7 males, 95% Caucasian and 5% African American. There were 21 students with an average age of 19.4 years in the COR condition – 15 females and 6 males, all of whom were Caucasian. There were 21 students with an average age of 18.4 years in the passive condition – 17 females, 4 males – 85% Caucasian, 5% African American, and 5% other (one participant did not indicate race). There were 22 students with an average age of 18.7 years in the control condition--13 females, 9 males, 95% Caucasian, 5% African American. Across conditions, most participants were in their first (77%) or second year (13%) of college and majoring in Nursing (24%) or Physical Education (23%). Sixty-nine percent of the students had grade point averages (GPA) between 2.6 and 3.5 on a 0-4 scale.

Apparatus and Materials

Each of the four groups viewed one of two videos (*Sensation and Perception* or *Learning*) from Annenberg's *Discovering Psychology* series hosted by Dr. Phillip Zimbardo in a digital streaming format accessed from http://www.learner.org/resources/series138.html. A laptop computer with the TurningPoint® SRS system, response devices, and radio frequency (rf) receiver was used to project questions digitally from a PowerPoint presentation. Three PowerPoint presentations were produced based on the same content material but using different formats—10-option multiple-choice used in the SRS condition, fill-in-the blank used in the COR condition, or a statement with the main point underlined and in bold used in the passive condition. The TurningPoint® SRS system used was only capable of multiple-choice or True/False responses, thus requiring the different question formats. All participants also received a post-test consisting of 30 multiple-choice questions (70% factual and 30% conceptual) on the topic of visual perception. Note that the post-test topic only matched one of the Annenberg *Discovering Psychology* videos. The other video (*Learning*) was used as a control condition. Other materials include a demographic sheet and 3 x 5 inch note-cards.

Procedure

Participants were randomly assigned to one of four conditions—SRS, COR, passive, or control. In each condition, one of four experimenters (who alternated between conditions across sessions) escorted participants to a separate small classroom (with a capacity of approximately 20-30 students) and asked them to complete informed consent and demographic sheets. In all four conditions participants viewed an approximately 20 minute psychology video. In the SRS, COR, and passive conditions, the *Sensation and Perception* video was presented, and in the control condition the *Learning* video was shown. In the SRS, COR, and passive conditions the video was paused approximately every minute, and a PowerPoint slide displaying a key point made in that segment of the video was shown, whereas in the control condition, the video was presented without pauses. In addition to video content, the format of the PowerPoint slides and degree of student participation differed between conditions, as described below.

In the SRS condition, a multiple-choice question based on a key point addressed in the *Sensation and Perception* video was presented visually on a PowerPoint slide and read aloud by the researcher. A 10-option list of choices for each question was used to

make the discrimination between the correct and incorrect answers challenging and more similar to that in the COR condition. The content of the multiple-choice question was the same as that presented in the COR condition.

One difference between the SRS and COR conditions was the format of the material. In the SRS condition, participants were instructed to individually select an answer from the list provided on the screen and answer it by pressing the appropriate buttons on their RRD. Once all the participants' answers were entered, the researcher presented a slide with a histogram depicting the percentage of participants in that group who selected each of the multiple-choice options. The researcher described the graph in terms of the percentage of participants who made each selection and then, on the next slide, read the statement with the correct word(s) filled in.

Another difference between the SRS and COR conditions was that participants were not required to write the correct answer in the SRS condition. This procedure was implemented to more realistically portray use of the SRS under typical classroom conditions. Following the answer slide, the next video segment was presented, then the next question, and so on until all 18 questions had been presented.

In the COR condition, a fill-in-the blank question based on a key point addressed in the *Sensation and Perception* video was presented visually on a PowerPoint slide and read aloud by the researcher. Participants were instructed to write down their answers to complete the statement on a 3 x 5 inch card and hold the card up at their foreheads so that other participants could not view any individual student's answer. The researcher then checked that an answer was made. To prevent an individual student from changing his or her answer, participants were instructed to place their completed cards in an envelope. A slide was presented with the correct word(s) shown to complete the statement and read aloud by the researcher. Similar to past research using the COR method (Alba & Pennypacker, 1972; Lee-Vieira, Mayer, & Cameron, 2006), which require mastery before moving to the next item, participants were instructed to write the correct answer on their answer sheet, whether or not they had previously answered correctly. Following the answer slide, the next video segment was presented, then the next question, and so on until all 18 questions had been presented.

To determine the effect of an active format on learning the material, the passive condition was implemented. In the passive condition, statements based on a key point addressed in the *Sensation and Perception* video were displayed on a PowerPoint slide and read aloud by the researcher. The key point word(s) were underlined and in bold text. As in the SRS and COR conditions, the video was paused at intervals and the slides presented. The statements were identical to the correct answer slides presented in both SRS and COR conditions. Participants were not asked to respond in any way to the information provided in this condition.

A control condition was implemented to assess participants' prior knowledge of sensation and perception. This condition differed from the other conditions by presenting, with no pauses or interspersed questions, the *Learning* video rather than the *Sensation and Perception* video which the other three groups viewed.

Following the training session, participants in each condition completed a 30-item multiple-choice post-test concerning visual perception.

Following the post-test, each participant was given a four- or six-item (depending on the condition) subjective evaluation questionnaire to complete. As applicable to the condition, participants were asked to rate, along a seven-point Likert-type scale, the degree to which: (a) information received was useful for their understanding of the material, (b) the method of instruction helped them prepare for the test administered after it, (c) their answer was carefully chosen, (d) close attention was paid to whether an answer was right or wrong, (e) they tried their best to learn the material, and (f) they enjoyed the method of instruction. Following completion of the questionnaire, a debriefing statement describing the overall study and its purpose was read aloud by the experimenter to the participants.

A measure of retention of learning was also collected approximately two weeks after the experiment. As part of a multiple-choice exam held during class, eight questions, which were variations on the questions asked in each experimental condition, were administered.

The dependent variables consisted of the post-test scores, ratings from the subjective evaluation questionnaire, and retention test scores. Learning and retention gain scores were also calculated. Learning gain is defined as the number of items participants answered incorrectly during the review session and correctly during the post-test for that matched item. Retention gain is the number of items for which both learning gain and a correct response to the matched question on the course exam occurred for each participant.

Reliability procedures were conducted with 33% of the sessions. Reliability was measured by an independent observer reviewing video-taped session procedures and scoring whether procedures were followed correctly. Procedural and interobserver reliability scores were calculated by dividing the number of researcher and observer agreements by the

number of agreements plus disagreements and multiplying by 100. Procedural reliability scores for delivery of the correct test materials, instructions, video, questions, and feedback were 100%. Interobserver reliability scores for participants' answers during training in the COR condition and subjective evaluation were 100%. Since test scores were automatically entered into the computer from machine-read scantron sheets, no reliability measures were required. Similarly, the SRS training session data were automatically collected and so did not require reliability procedures to be performed.

Results

Training Scores

There were differences between experimental conditions in percent correct responding during the training session. Participants' mean scores (percent correct) during the training session were higher in the SRS condition compared to that in the COR condition (SRS n = 15, M = 63%, SD = .37; COR n = 21, M = 32%, SD = .35. $t(8) = -3.565$, $p < .05$). Participants performed better on the recognition task (SRS) than on the recall task (COR). No training session scores were collected in the passive or control conditions due to the nature of those conditions.

Post-Test Scores

Participants' post-test performance was examined to determine the effects of review format on learning. Mean post-test scores for participants in the SRS condition (M = 64.3%, SD = .14, SE +/- .03) were significantly different from those in the passive (M = 55.9%, SD = .11, simple contrasts, $F(1,80) = 6.0$, p = .01) and control conditions (M = 41.1%, SD = .11, $F(1,80) = 46.3$, $p < .001$). Moreover, mean post-test scores for participants in the COR condition were significantly different from those in the passive (simple contrasts, $F(1,80) = 5.0$, $p < .05$) and control conditions ($F(1,80) = 44.2$, $p < .001$). Mean scores in the SRS condition did not significantly differ from those in the COR condition $F(1,80) = 0.06$, p = ns). These results suggest that participants performed better in the more interactive conditions (SRS and COR) compared to passive and control conditions.

Gain Scores

Participants' learning gains in the SRS and COR conditions were compared (see Figure 1). Learning gain is defined as the number of items participants answered incorrectly during the review session and correctly during the post-test for that matched item. The mean learning gain scores for participants in the SRS

Figure 1
Participants' Gain Scores in the SRS and COR Conditions

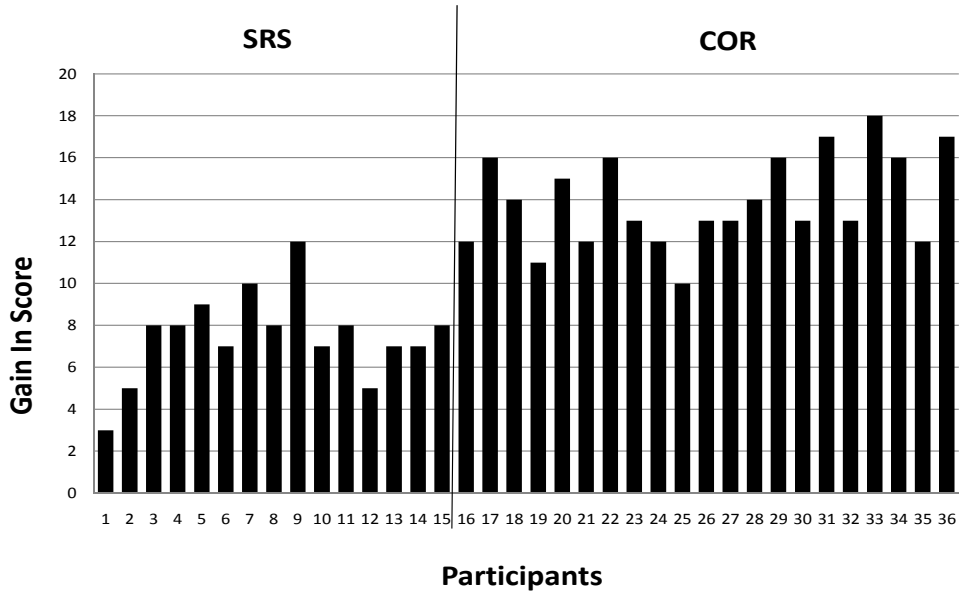
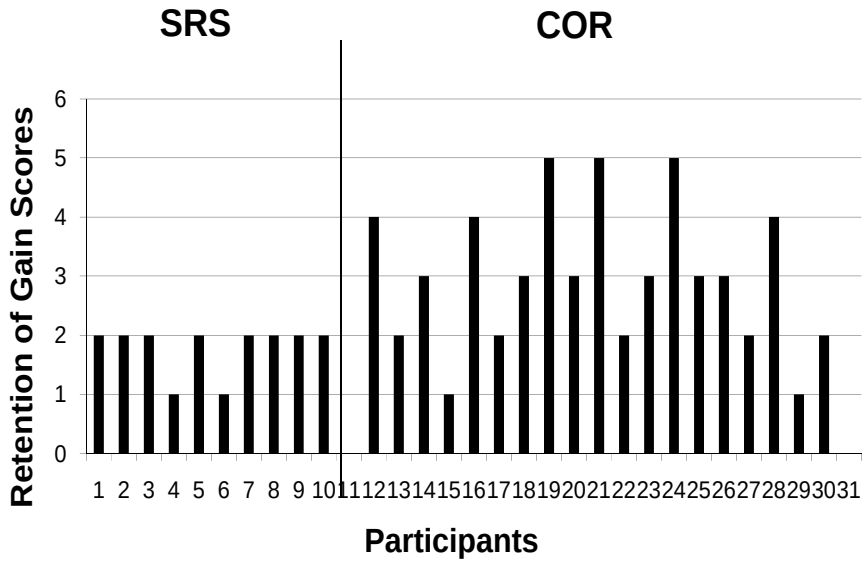


Figure 2
Participants' Retention of Gain Scores in the SRS and COR Conditions



condition (M = 7.5, SD = 2.1, SE +/- .6) and COR condition (M = 14.0, SD = 2.2, SE +/- .5) differed significantly ($t(34) = 8.8$, $p < .001$). As seen in Figure 1, only one participant's score in the SRS condition overlapped with all participants' scores in the COR condition.

Retention Scores

A measure of retention was calculated based on students' answers to eight matched test items during a course exam administered approximately two weeks after the review session. There were no significant differences in overall retention scores between SRS (M= 5.9, SD = 1.5, SE = 0.4, N = 15), COR (M= 5.7, SD = 1.7, SE = 0.4, N = 19), passive (M= 6.0, SD = 1.4, SE = 0.3, N = 21), and control (M= 6.2, SD = 1.2, SE = 0.2, N =21) conditions ($F(3, 75) = 0.4$, p = ns).

We also examined retention of gain scores as a more sensitive measure of the individual's acquisition of learning material when compared to the overall retention score (see Figure 2). The participant's retention of gain scores refers to the number of items in which both learning gain (i.e., items incorrect during the review session and correct during the post-test) and a correct response to the matched question on the course exam occur. Participants' mean retention of gain scores in the SRS condition (M = 1.8 SD = .94, SE +/- .27) ($t(29) = 2.09$, $p < .05$) were inferior to those in the COR condition (M = 2.79 SD = 1.39, SE +/- .32).

Subjective Evaluations

Participants' subjective evaluations of their experiences in each condition were examined (see Table 1). A significant difference was found in participants' mean ratings between conditions regarding whether they *received useful information* ($F(3, 75) = 8.3$, $p < .001$). A Scheffé post hoc test showed that participants in the SRS ($p < .01$) and COR ($p < .01$) conditions rated that they received more useful information than those in the control condition.

Participants' mean ratings regarding whether *the method of instruction used in this session helped them prepare for the test given after it* significantly differed between conditions ($F(3, 75) = 7.84$, $p < .01$). A Scheffé post hoc test revealed that participants' mean ratings in the SRS ($p < .01$) and COR ($p < .05$) Conditions significantly differed from those in the control condition. Participants' mean ratings in the SRS condition were also significantly different from those in the passive condition ($p < .05$).

Participants' mean ratings showed a significant difference in *enjoyment of the method of instruction* between conditions ($F(3, 75) = 4.76$, $p < .01$). A Scheffé post hoc test showed that participants' in the SRS condition rated their session as more enjoyable compared to those in the passive condition ($p < .01$).

On the subjective evaluation questionnaire, participants were asked in the SRS and COR conditions whether they *carefully chose their answer* and *paid*

Table 1
Mean (Standard Error) Agreement Ratings of Subjective Evaluation Questions Along a 7-point Rating Scale Labeled 1 = *Agree completely*, 4 = *Neither agree nor disagree*, and 7 = *Disagree completely* for each condition

Evaluation Question	Condition			
	SRS	COR	Passive	Control
1. I received useful information concerning my understanding of the material being taught during this instructional session	2.5(0.2)	3.0(0.3)	3.6(0.3)	4.5(0.3)
2. The method of instruction used in this session helped me prepare for the test given after it	3.3(0.4)	4.1(0.3)	4.7(0.3)	5.6(0.4)
3. I enjoyed the method of instruction I received during this session	3.3(0.4)	4.6(0.4)	5.2(0.3)	4.4(0.4)
4. I carefully chose my answer to each question presented during the instructional session	2.3(0.3)	3.3(0.3)	n/a[1]	n/a[1]
5. I paid close attention to whether my answer to a question was right or wrong during the instructional session.	1.9(0.3)	2.8(0.3)	n/a[1]	n/a[1]

Note. [1.] Passive and control conditions did not include an instructional session.

close attention to their answer during the instructional session. These two questions were only applicable in the SRS and COR conditions. Participants in the SRS condition indicated that they took more care in answering questions than those in the COR condition ($t(36) = -2.44$, $p < .05$). There was no significant difference for participants' ratings of whether they *paid close attention* between the two conditions (p = ns).

Discussion

Students performed better in the interactive conditions – SRS and COR – than in passive and control conditions. This superiority of interactive conditions over the other conditions was replicated across three learning measures: post-test, learning gain, and retention of gain scores. When comparing interactive conditions, participants' mean scores in the SRS condition were surpassed by those in the COR condition both in terms of learning gains and retention of learning gains, although not for post-test scores. Despite inferior gain and retention of gain, participants perceived instruction in the SRS condition as more enjoyable than those in the passive condition and more useful than those in the control condition.

In general, the results of this study are consistent with the past research in several respects. Interactive teaching methods produce higher participant post-test scores than passive conditions (Davis, Bostow, & Heimisson, 2007; Dufresne et al, 1996; Sokoloff & Thornton, 1997; Thomas & Bostow, 1991; Tudor, 1995; Yoder & Hochevar, 2005). A few studies have found that outcomes from some interactive methods (e.g., response cards, flashcards) may be similar to those produced using SRS (Lasry, 2008; Stowell & Nelson, 2007). Moreover, past research suggests that the COR method produces superior gain scores compared to a multiple-choice format (Alba & Pennypacker, 1972; Edwards & Arthur, 2007). In addition, the results support the observation that SRS methods are generally preferred by participants, regardless of actual outcomes (Beekes, 2006; Davis & O'Neill, 2004; Dufresne et al, 1996).

Our results build on past research. We experimentally evaluated the instructional effectiveness of SRS, which has been infrequently done by

researchers in the past. Furthermore, we compared participants' performance in the SRS condition to that in the passive and control conditions as well as to COR, another interactive method.

Post-Test Scores

Participants' post-test scores in the SRS and COR conditions did not significantly differ from one another, although both differed from those in the passive and control conditions. This result may have occurred for a number of reasons. Interactive methods require participants to respond to the instructional material which may by itself or, in combination with increased attention to the relevant information, contribute to improved performance. Moreover, by providing the participants with feedback for their answers, the correct answer is reinforced. Passive conditions make no such demands on participants, allowing them to choose whether to attend to the instructional material. Passive conditions also fail to assess student understanding of the instructional material.

Gain Scores

Participants' gain scores (the difference between initial correct answers during the instruction phase and correct answers on the post-test) in the SRS condition were significantly lower than those in the COR condition. This difference in gain scores may be an artifact of the training approach. It is also possible that the multiple-choice questions in the SRS condition cued or prompted the selection of the correct answer (a recognition task) while participants in the COR condition were not given any cues (a recall task). Past research has shown better performance on recognition tasks compared to recall tasks (Arthur, Bennett, Stanush, & McNelly, 1998). In our study, an attempt to mediate this inequality in task performance between conditions was made by including 10 possible options for each multiple-choice question in the SRS condition instead of the usual four or five.

The response entry procedure may have also contributed to the difference in gain scores between interactive conditions. Participants in the COR condition wrote the correct answer at least once, whereas participants in the SRS condition were never required to write the correct answer. Writing an answer, as opposed to selecting a letter, provides practice with emitting the correct response. The COR methodology requires that participants write the correct answer to facilitate learning (Alba & Pennypacker, 1972; Lee-Vieira, Mayer, & Cameron, 2006), and to avoid reinforcing an incorrect response. Thus, in the COR condition participants initially had fewer correct answers, but on the post-test their performance was more similar to those in the SRS condition. Typical classroom use of the SRS does not require students to write down the target word or phrase.

Subjective Evaluation

Our results found that participants perceived the SRS condition as more enjoyable compared to those the passive condition. Favorable opinions of an instructional method may lead to increased attendance, exposure to the learning material, and better grades compared to unfavorable views (Marmolejo, Wilder, & Bradley, 2004).

Participants in both SRS and COR conditions rated their condition as more useful and helpful than those in the control condition. This result was possibly due to the features of the SRS and COR conditions--feedback and active responding to the learning material were present in the interactive conditions and not in the control condition. Additionally, those in the control condition saw a video unrelated to the post-test.

Participants in the SRS condition reported taking more care in arriving at their answers than in the COR condition. Selecting one of the ten multiple-choice answer options in SRS condition may have required more attention to details than simply producing an answer, as was the case in the COR condition.

Future Research

Several interesting questions remain to be answered in future research. For example, how well do the results of this study generalize in terms of context, testing approach, and type of response input? To evaluate the effectiveness of SRSs we arranged a more controlled environment than typically is present in classroom instruction (i.e., by using a video-taped lecture and collecting subjective evaluations). Whether our results are replicable in an actual classroom situation where instruction is more free-flowing and guided by students' responses should be tested.

Another unanswered research question concerns the type of test administered. Would the same results occur if questions on the post-test and retention test consisted exclusively of fill-in the blank versus multiple-choice? How much did use of multiple- choice questions contribute to participants' performance in the SRS condition versus the COR condition? The present experiment used only a multiple-choice test to standardize and simplify the administration. Perhaps the results would differ if test format were matched to condition (e.g., if the COR condition participants completed a fill-in-the-blank test).

An important question is whether technology is necessary in training situations for optimal student learning. Moreover, if technology does make a

difference, would an SRS that allows word input via the RRD provide greater learning gains than either a manually constructed response or a system that requires multiple-choice letter selection? The SRS utilized in our experiment does not allow users to input specific words, thus limiting the form of the response to multiple-choice format. The selection of a letter via multiple-choice format may lessen the learning value compared to inputting the answer in actual word form.

The role of anonymity in encouraging interactive participation also requires exploration. The lack of individual identification inherent in a SRS may contribute to honest and uninhibited answering when compared to other interactive methods which may preclude anonymity by virtue of their design. In the COR condition participants revealed their answers to the researcher in a way that made it difficult for others to see. The experimenter, however, was required to check that everyone had made some response, thus forcing participants to expose their personal answers to another person. SRS technology that allows word input would allow for participant response anonymity in recognition and recall conditions.

The use of SRS technology is a fairly costly approach compared to other interactive classroom methods. The results of this research suggest that an alternative (i.e., COR) is as effective as the SRS method in terms of participants' learning. Additional research will help to clarify the extent to which these instructional methods can be successfully added to the interactive teaching toolbox.

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The Importance of Being Human: Instructors' Personal Presence in Distance Programs

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Literature on the role of higher education distance instructors mostly focuses on their teaching role, involving tasks such as curriculum design, instruction, and facilitating student learning. What is missing is the role of the "person" of the instructor, defined as his or her personality, identity, integrity, emotions, thoughts, beliefs, and values. The aim of this study was to ascertain whether distance students want a personal presence from their instructors, and if so, how an instructor's personal presence might impact on teaching and learning in the higher education sector. Qualitative analyses of 68 surveys and a focus group interview found that, while a minority of students report not wanting instructors to have a personal presence, most highlight the need for engaging, passionate, and understanding instructors who show these attributes through self disclosure, relationship building, humor, and individualized feedback. At the same time, instructors' personal qualities need to be mediated through learning. Various modes were identified that might encourage a personal mode of distance teaching, though the teaching medium did not appear to matter as much as having an instructor who, in the words of one participant, was "human."

University instructors and other professionals bring more than their professional skills and knowledge to practice: they also bring various personal qualities (Jeedawody, Reupert, Rushbrook & Reid, 2006). While the personal and the professional are intertwined, by personal we include instructors' personality, identity, integrity, emotions, thoughts, beliefs, values, life experiences, and background (Palmer, 1998). This article explores whether higher education students, studying in distance mode, want an instructor's personal self to be visible and active, how these personal qualities might impact on teaching and learning, if at all, and what form the personal self of instructors should, or could assume within distance education.

The use of one's self or personhood is a concept that is most often found in the therapeutic literature (see for example, Baldwin & Satir 1987; Brothers 2000; Reupert, 2008) but also in other human service professions, including social work (Reupert, 2007), nursing (Akerjordet & Severinsson 2007) and teaching (Palmer, 1998). Palmer (1998) points out that good teaching cannot be reduced to technique but instead "comes from the identity and integrity of the teacher." (p. 10). Increasingly the use of self is being recognized as a trans-disciplinary concept (Jeedawody, Reupert, Rushbrook & Reid, 2006). Whilst the following quote by the renowned family therapist Satir (1987) refers to therapy, "therapist" could, we argue, be substituted for "instructor," "patient" for "student," and "treatment" for "education":

> Common sense dictates that the therapist and the patient must inevitably impact on one another as human beings. This involvement of the therapist's "self" or "personhood" occurs regardless of, and in addition to, the treatment philosophy or approach. Techniques and approaches are tools. They come out differently in different hands. (p.19)

Specifically in relation to teaching, Marsh and Bailey (1993) through a meta-analysis of students' evaluations found that teaching effectiveness is primarily a function of the instructor who teaches a course rather than of the course that is taught. Similarly, Husbands (1997) found that some instructors are evaluated by students more highly than other instructors teaching in the same mode, in the same course. These results suggest that it is the manner in which a subject is interpreted and implemented by the individual instructor, rather than course materials, which impacts on student outcomes. Whilst these results might be attributable to variations in instructors' professional experiences and skills, and/or other attributes such as gender, they might also result from the personal characteristics of individual instructors and how these personal qualities are enacted within the teaching environment.

Related to the concept of "personhood" is that of "instructor presence," defined as being salient and visible to learners in either distance or face-to-face classrooms. While interaction on its own does not necessarily equate to presence (Picciano, 2002), it is generally agreed that instructor presence involves frequent and meaningful communication from an instructor to his or her students, especially in distance education. Further refining this concept, Anderson, Rourke, Garrison and Archer (2001) define teaching presence as "the design, facilitation, and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes" (Describing Teaching

Presence section, para. 1). This definition is based on an earlier framework which conceptualized instructor presence in three parts (Garrison, Anderson & Archer, 2000). The first element of teaching presence involves being an instructional designer of the educational experience, in terms of planning curriculum, establishing time parameters, administering instruction, and offering student evaluation. The second role is that of facilitator of discourse and co-creator of a social environment. This aspect of presence involves the instructor identifying areas of student agreement and disagreement, seeking to reach consensus and understanding amongst students, acknowledging and reinforcing student contributions, setting the climate for learning, drawing in students, and prompting discussion. The role of the lecturer here is to create and maintain a social environment that is conducive to learning and is "*in situ* design of instructional activity" (emphasis included, Anderson et al., 2001, "Facilitating Discourse" section, para. 3). The final aspect of instructor presence, identified by Anderson et al. (2001) focuses on direct instruction and involves the instructor presenting content and questions, focusing the discussion on specific issues, summarizing discussion, confirming understanding, diagnosing misperceptions, injecting knowledge from diverse sources, and responding to technical concerns. Thus, instructors can become present or visible in many ways, though on the whole need to focus on enhancing the teaching and learning environment for distance students. Instructor presence in this model is focused on pedagogical issues, even when targeting the social cohesiveness of the student body. Thus, it could be said that, whilst instructor presence is a concept that has been extensively discussed and researched (Anderson et al., 2001; Garrison & Cleveland-Innes 2005; Picciano, 2002; Rourke, Anderson, Garrison, & Archer 2001; Shin, 2003), the concept of the instructor's person, or what might be called instead "personal presence," is not acknowledged or addressed. In other words, whether the person of the instructor is a part of this presence and/or how it might be enacted has not been explored.

Another body of related literature has examined instructor immediacy behaviours, defined by behaviours that reduce social and psychological distance between people (Arbaugh, 2001). Some have argued that instructors achieve presence through certain verbal behaviours including humor, providing and inviting feedback, and learning students' names, as well as nonverbal behaviour such as eye contact, smiling, and movement (Arbaugh, 2001; Freitas, Myers & Avtgis,1998; Menzel & Carrell 1999; Myers, Zhong & Guan, 1998; Rodriguez, Plax & Kearney, 1996; Sanders & Wiseman, 1990; Swan, 2002; Weiner & Mehrabian, 1968; Witt, Wheeless & Allen, 2006). Appropriate or engaging immediacy behaviours have been associated with student motivation and learning in online as well as on-campus learning environments (Freitas, Myers & Avtgis, 1998; Menzel & Carrell, 1999; Myers, Zhong & Guan, 1998; Rodriguez, Plax & Kearney, 1996; Shin 2003). Additionally, researchers have compared immediacy and learning among different cultural and ethnic groups, generally finding a positive relationship between nonverbal teacher immediacy and students' perceived learning (Witt, Wheeless & Allen, 2006).

Other research has examined the role of distance instructors. For example, Johnson (2001) argues that distance instructors need to provide (1) open-ended complex questions, (2) the real work context, (3) shared goals (4) cognitive organising tools, and (5) facilitation. Berge (1995) categories four major functions for online facilitators, including that of manager, social facilitator, pedagogical facilitator, and provider of technical support. Collectively, previous research and literature on presence, immediacy, and role emphasizes the teaching responsibilities of higher education distance instructors. The focus in these studies is on instructors' development and organization of teaching materials and the instructor's role in facilitating an effective educational process, while the "person" of the instructor is missing.

But do distant tertiary students want the 'person' of their instructor? Several studies have found that distance students are attracted to distance courses because of their flexibility (Daughtery & Funke, 1998; Polloff & Pratt, 2001; Tricker, Rangecroft, Long & Gilroy, 2001). More specifically, Conrad (2002), in a survey of first year graduate students, found that distance students wanted instructors to provide clarity and comprehensiveness of instructions rather than fulfil a "caring role," and in her words, to be seen "not as a personality, but as a course resource" (Conrad, 2002, p. 222). Similarly, Gorsky, Caspi and Trumper (2004) found that distance students preferred to study on their own, concluding that there is often a gap between distance education theorists who espouse interactional models of teaching and what distance students actually prefer. Such research suggests that distance students are willing to sacrifice face-to-face, personalized teaching for the flexibility and convenience of distance education.

However, while distance students might not *want* a personal relationship with their instructor, they might well *need* it for a successful learning experience. For example, in the above mentioned study by Gorsky, Caspi and Trumper (2004) even though students preferred individualized study, when they failed or struggled, students opted for more interactional systems of teaching and learning. Isolation, one of the major causes of withdrawal from university studies in distance mode (Hipp, 1997; Peters, 1992; Polloff & Pratt, 2001), is defined as physical isolation, from human and

material resources, as well as psychological isolation in which the student feels disengaged from the lecturer and his or her peers, and the university institution (Lake, 1999). Distance education students tend to have higher drop out rates than students in traditional courses (Carr, 2000) for many interrelated reasons, some related to the course, some not. Thus, whether distance students want or need the personal presence of the instructor, and what form this could assume, is still a question that appears unanswered.

Some argue that distance teaching does not have the same capacity, when compared to face-to-face teaching, to transmit the lecturer's presence in an immediate and effective way (Flaherty, Pearce & Rubin, 1998). Similarly, others have criticized the distance experience for students, arguing that distance education can lead to ambiguous communication from the lecturer, isolation, frustration, boredom, overload, and low course completion (Hara & Kling, 2000; Northrup, 2002). Price, Richardson and Jelfs (2007) compared the experiences of students taking the same course by distance with those taking the course on campus and found that distance students reported poorer experiences. Students reported that the face-to-face sessions were seen not only as an academic activity but also as a highly valued pastoral activity in which lecturers' presence was essential. Finally, Miller, McKenna and Ramsey (1993) found that student-lecturer interactions are reduced in distance environments (even though there might be technological support for this to take place), and that distance students report a decreased sense of belonging, as compared to students studying on campus.

Thus, the research is mixed regarding the place of the instructor's personal presence in distance education courses. Should instructors merely be a resource to students? And/or should instructors reveal more about themselves as people? Should higher education instructors, as Coombs-Richardson (2007) advocates, provide a "personal touch" such as sending individual emails to students and other forms of personal attention? If distance students want a more personalized approach from instructors, how does this impact on teaching and learning and not just subject satisfaction or "liking" an instructor? Some students might confuse "popular" with "effective" educators. For example, one study showed that students give higher ratings to instructors they perceive as "sexy" (Felton, Mitchell & Stinson, 2004). Consequently, it is important to identify how an instructor's personal presence might be associated with specific teaching practices and subsequent student learning, rather than qualities students might merely "like" or consider "ideal." Finally, if important, how might instructors teaching in distance education best facilitate a personal presence? Are there modes of distance education that are more personalized than others, according to students? These are the research questions within which this qualitative study is framed. Such information is seen as useful as it can lead to the development of innovative strategies to promote quality teaching in distant programs.

Methodology

Theoretical Framework

Within an interpretative research paradigm, a qualitative approach to data collection was employed as a means of tapping students' attitudes about the personal presence of their instructors. Mahrer (1988) labelled such an approach "discovery orientated" as opposed to "hypothesis-testing." The intention of discovery orientated research "is to learn more… to answer a question whose answer proves something one wants to know but might not have expected, predicted, or hypothesized" (Mahrer, 1988, p. 697). As the personhood of the higher education instructor is a concept that has not been previously investigated, the open ended, exploratory nature of qualitative research was considered the most appropriate framework to employ.

Participants and the Recruitment Process

After ethics was provided by the university's ethics body, potential participants were invited to participate via an email sent to all second year distance psychology students studying statistics, a mandatory subject for course completion. The first of two ways that students participated involved a focus group interview, when they attended a residential school mid-way through the subject. A semi-structured interview was used for this focus group that consisted of seven female participants, aged from 22 to 50, with a mean age of 37 years.

Students were also invited to complete an online survey at the end of the semester, with similar questions asked of the focus group. Of the students enrolled (128), 68 responded, giving a response rate of 53%. Fifty-six of the students were female (82.4%), while 12 were male (17.6%). The mean age of the students was 38.4 (SD = 9.8). In terms of experience in undertaking distance education subjects, the students were varied, with the distribution being highly positively skewed. The mean number of distance education subjects previously taken was 6.4, the median was 4.0, and the mode was only 1 (SD = 8.4). The inter-quartile range was 6.25 (with the 75th percentile being 8.25 subjects and the 25th being 2 subjects). Overall, students were generally quite experienced in studying by distance education mode, and most were mature aged.

Procedure

Questions in both the survey and focus group were framed around the personal qualities of distance instructors and how an instructor's personal presence might impact on teaching and students learning, if at all. Semi-structured questions were framed around the following four areas.

1. As a distance education student, is it important for the instructor to have a personal presence in your subject? If yes, why? If no, why not?
2. What are the important personal qualities, if any, that instructors bring to distance teaching?
3. Impact on teaching and learning:
   a) What do these personal qualities look like in terms of instructors' teaching practices (if at all)?
   b) How do these personal qualities impact on your learning (if at all)?
4. How might instructors make distance education more personalized, if at all?

Data Analysis

The focus group interview was recorded, and a qualitative content analysis with an inductive approach was applied (Berg, 2004). In the first instance, the first two authors independently went through the transcript several times to identify overall themes and content corresponding to the four research questions. These text units, including words, sentences, or whole paragraphs, were highlighted, and notes were made about the content. Focused coding followed, which moved the process to a conceptual level (Charmaz, 1983). Categories were created and named from participants' words and the researcher's perspective, as informed by the previous literature review (Constas, 1992). The first two authors independently organized these codes into themes, and then met to negotiate a final consensus. Each of the 68 surveys were analysed in a similarly inductive manner by the first two authors, first independently, and then together to reach a consensus. Finally, the survey and focus group data were pooled and presented according to the four research questions.

Results

As previously described, information from the survey and focus group interviews were grouped according to the structure of the questions asked and are reported as follows:

1. Relative importance of an instructor's personal qualities;
2. The important personal qualities instructors bring to teaching;
3. How instructors' personal qualities impact on (i) teaching and (ii) learning; and
4. How distance education might become more 'personal."

Relative Importance of an Instructor's Personal Qualities

The majority of students, including all the focus group participants as well as 63 of the 68 survey participants, reported that it was important for instructors to, in the words of one participant, "*be human."* These students highlighted the need for the teaching environment to be an interpersonal place in which both students and instructors communicated as people.

One student reported that there was a distinct difference between distance subjects, reporting that "*some subjects have emotion in them, while others are dead and rigid,"* a tone she attributed to the instructor. The importance of the personal qualities of the instructor was further emphasized by the focus group with representative comments including:

> It is difficult to show yourself [as an instructor] in distance subjects, but it is how you [the instructor] write, how much emotion you put into it, how you react to students, how often you react to students, all these things impact on me as a distance student.

> It is important to me, as a human being to interact, not with a computer, or a book, but with others, who know more about this subject than I do. They need to be there, to bring it to life, they need to show their human side….

At the same time, there were five female survey respondents (no focus group participants) who strongly argued that this was not the case:

> Not really, never see them, rarely talk to them, [and] don't want to really.

> I don't really care if the subject is taught in a way that's personable or not. If I wanted, I'm in a position to study on-campus but choose not to.

> I don't really care how "friendly" the lecturer is; we're not here to be friends. I want the lecturer to be dedicated to the subject and give direct answers to questions (when they can).

> I actually find I am less distracted and take more in without all the "personalities" of staff and students.

> I have a goal and nothing will stop me from achieving it.

Another female survey participant added the following qualifier:

> I choose distance education partly because I prefer to be independent in my learning, BUT it is nice to know the lecturers are there when I need them.

Whilst there might have been some disagreement as to its value, most students agreed that the instructor's personal presence was inevitable:

> I get a picture in my head as who the lecturer is, even if they don't give much of themselves away…you can tell something about them from the package, the assignments…all of my [distance] lecturers have been different and that says something about who they are as people, I suppose.

> Well, the person of the lecturer is something that is out there, you can see it in everything they do and say, even if that's not a lot. Sometimes you get the feeling that they are involved and interested [in us,] and others you get the feeling that they are too busy and don't have time for us. You work out their personalities in all these things.

Not only was it inevitable, the majority of survey participants and all the focus group participants suggested that it was important for the instructor to make visible his or her personal presence. The personal qualities that distance students considered to be important are described below.

The Personal Qualities Instructors Bring to Distance Teaching

When describing the important personal qualities that instructors bring to distance teaching, students identified several, interrelated personality traits. In the first instance, the ability to engage with students was highlighted:

> The ability to engage, not just present information, is very important to me.

> A sense of openness to connecting with students is essential to DE teaching.

As well as being engaging, a related personal attribute was being approachable:

> It is important that the teaching staff are very approachable and there are no stupid questions

> [you need to be able to] approach your lecturer/tutor and [know] that they have a genuine interest in your progress

> Generally I don't have the confidence to phone a lecturer but if they show that it is okay and that they are human, well it makes it easier for me to ring them and talk about what is happening.

Being engaging and approachable appeared to be important when establishing relationships with students. Then, according to students, once a relationship is established, instructors need to be empathic and understanding:

> [important that instructors have an] understanding of family demands and work commitments that distance students have on top of studying.

> Understanding that students have lives outside of the university is very important for distance students.

Patience when dealing with repeated students' requests was another important personal attribute for instructors to show:

> Sometimes it is difficult to work out what needs doing and then you know, the lecturers must get the same questions again and again, so yes, they definitely need patience.

Finally, a salient personal quality was for instructors to demonstrate passion and enthusiasm about their subject:

> I don't want a lecturer who just follows a textbook; they need to be up to date and enthusiastic about what they are teaching. They need to have a passion; otherwise we might as well just be reading about it.

> Making the content interesting and relevant is really important, especially in a subject like statistics, which could potentially be pretty boring and useless.

Thus, according to students, the essential personal characteristics of distance instructors focused on their ability to relate to students (being engaging, approachable, empathic and patient) and being passionate about their subject area.

Impact on Teaching and Learning

Specific teaching practices aligned to an instructor's personal self were identified, followed by how these practices might impact on students' learning.

Impact on teaching. Students report that at times the personal qualities of instructors came through in *how* they taught, that is, patiently, passionately, and enthusiastically. At other times the strategy was a direct result of the person of the instructor with specific teaching practices including self-disclosure, relationship building, humor, feedback, and good organization. For example, an effective teaching strategy identified by students was the ability of the instructor to link his or her own experiences to the subject material.

> Making the link to real life, like using examples from his or her [the instructor's] life so that we can see how it might relate to work situations is important.
>
> I like a lecturer to talk about his [sic] life... it can shine a light on the material being presented and helps me see it in different ways.

Here, self disclosure of the instructor's experiences was considered an effective teaching tool, when directly related and/or linked to the subject material.

Building relationships with students was closely aligned to the person of the instructor:

> Treating students as individuals and not as a large group or as a faceless person on the end of phone is important to me.
>
> Knowing my name is a good start and wanting to ask how things are going… I asked for an extension and it was good that the lecturer wanted to know how I was, was interested in what was happening for me. This was more than just teaching, it was building a relationship with me as a person.

Relationships with students were not necessarily personal, but instead consisted of the instructor knowing who his or her students were in order to more effectively work with them.

Humor was another personal quality that some students identified as a teaching tool:

> … the tone, sense of humor, writing manner of the staff is important.
>
> [an instructor's] sense of humor can take stress out of distance and [a] difficult subject.

However, other students were more tentative about an instructors' use of humor:

> ... humor might work though could also could foster stress.
>
> I like lecturers to have a sense of humor but in the past it has lulled me into a false sense of security thinking I was going OK.

Students also described the provision of individualized and timely feedback as personable:

> When we get our assignments back it is really important that there is something positive on it, even if other bits aren't so good. Often you get the impression that they[instructors] have lots to read, and they don't really read yours properly, they get bored, and you are just another number, not a student or a person....
>
> … quick email responses both on the forum [on line discussion group] and directly take some of the "distance" out, I think.

Finally, students reported instructors' sense of organization, or lack thereof, as another personal attribute related to teaching style:

> How a subject is laid out, having regular assessment items, getting regular feedback, having set chapters to read, all these are important and ways that we can see the personality of the lecturer.

Impact on student learning. The positive ways that instructors' personal qualities impacted on students' learning included feeling motivated, focused and less stressed. For instance, students suggested that if an instructor showed that he/she was passionate about the subject they in turn would also be interested in the subject:

> Some lecturers don't seem that interested. Having lecturers who actually appear to have a passion to want to teach makes me motivated to learn.
>
> The enthusiasm of the staff [can] spark my own enthusiasm.
>
> The engagement and warmth of a lecturer are important in making a subject 'come alive' and forming a connection with the subject matter

Similarly, if students saw the personal qualities of their instructors they were less likely to be distracted and instead, more focused:

> Well it means that I don't drift off, or get bored or otherwise distracted.

Instructors' approachability and engagement also relieved the stress for some students:

> When lecturers make themselves available, and give lots of feedback, I feel less stressed and more comfortable about where I am going.

In sum, instructors' enthusiasm, patience, and understanding appeared to impact on students' affective states.

How Might Distance Teaching Become More Personable?

Students had several suggestions for making distance education more personable, some of which they had experienced, but some they had not. Specific supports and techniques, all of which involved various forms of communication between instructors and students, included:

- voice over PowerPoint slideshows
- timely feedback
- weekly phone chat including chat room tutorials and lectures
- pod casting of the material
- residentials
- videos
- being allocated a contact person for problems, personal and teaching
- 2-3 smaller tutorials in regional centres
- personal emails

Students also mentioned an online discussion group or forum and the need for clear direction and support from instructors. For example, some suggested that

> There needs to be a forum but [it needs to be] interactive - on the forum, [instructors need to] ask for students to complete specific sections, then discuss.

> I have used forums often in the past, and on the whole find them to be confusing, dominated by needy personalities, without clear, concise instructions and directions. [I believe that] few students use forums efficiently. I can't help fellow students as I am usually struggling with my own understanding.

In the survey, two students reported that distance education did not have the capacity to express the personality of instructors, though they did not mention why. The same five students, outlined earlier, reiterated in the survey that they believed distance education should strictly focus on the teaching experience alone. Another reported:

> Distance education needs to be personable but in a flexible way. Subjects need to use a combination of materials such as CD-Rom lectures, forums, and residential [schools]. These things make it very personal for me, but [they] still need to be delivered with all the benefits offered by distance education, i.e,. flexibility to plan and pace study time.

Finally, several students made the point it was the person of the instructor that was important as opposed to the form or medium employed, for example:

> Lecturing staff who continually encourage, inspire, challenge and support students are going to make a difference when studying either on campus or via distance.

> I am not really into computers, but I do want a connection with the person who is teaching me. To me, it doesn't really matter if it is distance or not, or what materials are used… I need to see that the other person is a person, and is someone I can relate to, on both the subject material as well as on a personal level.

Discussion

A minority of students (five of the 68) wanted to focus on their studies alone, without what one student described as the "interference" of either students or instructors' personalities. At the same time, students perceived that instructors inevitably brought different aspects of themselves to teaching, which permeated at different levels of the subject. On the whole, the majority of students reported the need for distance instructors to provide a personal presence, describing this presence in terms of being engaging, approachable, understanding, patient, and passionate about the subject. These qualities were enacted through specific teaching strategies including self- disclosure, relationship building, humor (though there were qualifiers to this), provision of individualized and timely feedback, and organization. Many of the qualities and subsequent teaching strategies primarily

focus on the relational aspect of teaching and learning between instructors and students. Thus, the person of the instructor appears to be at the heart of establishing effective interpersonal relationships with students. For example, the strategies listed by students for making distance teaching more personable highlighted different ways of enhancing communication channels between students and instructors.

In contrast to Conrad (2002), who found that distance students preferred teachers to take on a teaching as opposed to a caring role, the students in this study wanted instructors who understood that students had commitments aside of their course responsibilities and had the ability to build relationships. Many of the attributes and teaching strategies outlined by students delineate an open and warm communication style, for instance, obtaining individualized feedback, being accessible, and showing understanding and empathy. Similarly in therapy, the person of the therapist has been directly related to the relationship building skills of the individual therapist (Reupert, 2008; 2009a).

However, whilst the majority of students said that they wanted a personal presence from distance instructors, this presence was still very much focused on the teaching and learning environment. For example, students wanted instructors to self disclose, but specified that self-disclosure should be linked to the subject in some way. Similarly, students wanted instructors to be present on forums to provide direction and organization. Humor was only appropriate, according to students, if it helped them achieve, and did not, in the words of one student, "lull" them "into a false sense of security." In other words, the personal presence of instructors, according to students here, needs to be channelled or mediated through subject materials and teaching strategies. An instructor's personal presence was important, but only if relevant to the subject and the student's learning. In the same way, relationships between students and instructors were important, but students made it clear that this was not a personal relationship, even if the instructor's personal qualities were instrumental in establishing it. Instead, the relationship was centred on students' learning and progress. Similarly, Garrison and Cleveland-Innes (2005) stress that the social interactions established by instructors need to be more than social:

> Although the natural and appropriate inclination [of instructors] is to first direct interaction efforts to establishing social presence and creating interrelationships, this is only a precondition for a purposeful and worthwhile learning experience. Teaching presence is important for the creation and sustainability of a community of inquiry focused on the exploration, integration, and testing of concepts and solutions (Garrison & Cleveland-Innes, 2005, p.135).

In other words, the personal qualities of instructors need to be active for students to see, but still linked to course objectives and used to support students to become part of a supportive learning community.

This study has limitations that could be addressed in future research. Students involved in this study were opportunistic; they wanted to be involved and came from the one subject only. Students from other disciplines and/or not studying in distance mode might have other views. We did not seek instructor input to ascertain what personal qualities they brought to their teaching and their views regarding the relationship between personal and professional aspects of themselves. Future studies could examine the connections between student and instructor views as well as the perspectives of higher education administrators.

Nonetheless, the results of this study demonstrate that distance instructors require more than technological expertise; they need to be able to communicate and engage with students using a variety of mediums, but without losing the flexibility that distance education affords students. According to the students, an instructor's personal presence is inevitable and will be perceived by students through instructors' attitude towards, and selection and organization of, their subjects, as well as their relational qualities. Students will surmise who their instructors are, regardless of whether this perception is accurate or not, and regardless of whether instructors intend for this to happen or not. Whether these personal qualities can be taught, and if so, how, is another matter that has been raised elsewhere (Reupert, 2009b). Given the implicit nature of personhood, we would argue that instructors need to be encouraged to purposefully channel personal qualities such as passion, understanding, and patience, and they should use self-disclosure, relationship building, and humor through their learning materials and interpersonal relationships with students. In this way they keep distance teaching "human."

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Thinking Statistically in Writing: Journals and Discussion Boards in an Introductory Statistics Course

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This action research combined qualitative and quantitative techniques to investigate two different types of writing assignments in an introductory undergraduate statistics course. The assignments were written in response to the same set of prompts but in two different ways: homework journal assignments or initial posts to a computer discussion board. A survey at the end of the semester elicited student reactions to writing in a statistics course, as well as to the two different types of writing they were asked to do. A majority of the students felt that the addition of writing to the course was beneficial to their learning. Student writing was analyzed to identify the types of writing found. Both forms of writing investigated allow students to engage in reflective thinking about statistics and to communicate their questions to their instructor. Both forms of writing helped students to improve their understanding of mathematics and their ability to communicate mathematically. The discussion board, however, engaged students in a dialogue, which allowed them to build on one another's thinking. The identification and classification of types of writing found in different kinds of student responses will allow future instructional decisions and point to further research.

For many college undergraduates, Introduction to Statistics is a scary course. This is true even for the students who one might think would see the study of statistics as useful or interesting, such as sociology or political science majors. One reason may be that most introductory statistics courses are taught within mathematics departments. Unfortunately, that means that many students who might otherwise be attracted to statistics let their fear or lack of confidence in mathematics "spill over" into their Introduction to Statistics classes (Conners, Mccown, & Roskos-Ewoldson,1998; Onwuegbuzie & Wilson, 2003.) When students are interested and engaged in the material, however, they are less anxious (Mitchell, 1997; Conners, Mccown, & Roskos-Ewoldson,1998; Kirk, 2002; for example); their instructors are better able to help them (Grossman, Smith & Miller, 1993; Shibli, 1992; Drake & Amsbaugh, 1994); and, perhaps even more important, the students learn more (Conners, Mccown, & Roskos-Ewoldson,1998; Geisbrecht, 1996; Shibli, 1992).

Hence, it makes sense to find ways to make the Introduction to Statistics course more interesting and engaging for students. One method is to focus on applications (Bessant, 1992; Kirk, 2002; Mitchell, 1997.) Providing opportunities for students to apply statistical concepts to real-world situations makes those concepts more meaningful to students. As Mathew Mitchell (1997) points out, "Students know they live in a complex world where consensus is an ideal rather than a reality" (p.11). Statistics can offer students a way to "make sense" of the world as they already perceive it. Another method is to ask students to write. In Mitchell's study (1997), writing assignments that asked students to use statistical concepts to write about topics that interested them were "perceived as highly relevant (or meaningful) by students" (p.11). Writing assignments can be intricately tied to applications-oriented methods, in that they often ask students to consider how the concepts they are learning in class apply to the world they live in and then to articulate their understanding in writing. Beins (1993), for example, identifies writing "press releases" about statistical data sets in laymen's terms as a form of active learning that uses real-world applications to help students learn statistical concepts. Beins concluded that students who wrote about statistics in lay language acquired better interpretative and computational skills. The range of writing assignments that statistics instructors have used is huge, and it includes term papers, short essays, notes, press releases, position papers, and journals.

The action research presented here combined qualitative and quantitative techniques to investigate two different types of writing assignments in an introductory undergraduate statistics course with an applications-oriented approach. The assignments were written in response to the same set of prompts but in two different ways: as homework journal assignments or as posts to a computer discussion board on a Blackboard course web site. Student writing was analyzed to identify the types of writing found, and a survey at the end of the semester elicited student reactions to writing in a statistics course, as well as to the two different types of writing they were asked to do. Identifying the types of writing students do in response to these assignments can help determine both the strengths and weaknesses of each as well as the ways in which students are using writing to learn statistics.

Writing for More Than Writing's Sake

Writing has been identified by key organizations as an important skill for all math and statistics students (ASA, 2005; NCTN, 1989, for example). One reason that the national organizations recommend integrating writing into mathematics and statistics courses is that writing assignments will make students better writers or mathematical communicators, and it is clearly the consensus of the field that statisticians need to be better writers (Beins, 1993). Samsa and Oddone (1994) point out, "Many people's first encounter with a statistician is through the written word; thus, the more clearly and persuasively we write, the more positively will our profession be viewed" (para 1). Stromberg and Ramanathan (1996) contend that it is "both easy and vital to include writing in the general statistical curriculum given the interdisciplinary nature of the subject" (p. 161). The more practice students have in writing about statistics, the better statistics writers they will become.

Integrating writing into statistics courses, however, is not only important because it gives students practice writing. There are several other reasons that may be just as important. For one thing, writing assignments have been shown to increase students' confidence as statistical thinkers and to alleviate some of the anxiety of taking statistics (Dillon, 1982; Smith, Miller & Robertson, 1992; Sgoutas-Emch & Johnson, 1998; Pan & Tang 2004). Kathleen Dillon asks her students to do a short piece of anonymous writing at the beginning of her undergraduate statistics courses, specifically about how they feel upon entering a statistics course, as an introduction to a discussion of math anxiety (Dillon, 1982). Researchers and instructors Pan and Tang (2004) combined two approaches to reducing statistics anxiety for their graduate students: a series of methods to increase the instructors' awareness of the students' anxiety and application-oriented teaching methods which involved both writing to lay audiences and writing journal article critiques (pp. 152-3). Their study indicated that these methods did have a statistically significant effect, as shown with pre- and post-test measures of anxiety. According to Pan and Tang (2004), anxiety about learning statistics may be due to a lack of mathematical background or skill, but it may also be due to misunderstandings about what the study of statistics is about (p. 149). Writing about why statistics might be useful, or why it is important to be statistically literate, may help students begin to connect to the subject matter in new ways.

Another good reason to integrate writing into the statistics curriculum is that reading what students write about statistics helps instructors understand when students are learning and when they need more help (ASA, 2005; Grossman, Smith & Miller 1993; Samsa & Oddone, 1994; Stromberg & Ramanathan, 1996, Drake & Amsbaugh, 1994). For example, Stromberg and Ramanathan (1996) demonstrated that short in-class writing at the beginning or end of a class period and "writer-based" informal journals can help an instructor evaluate students' understanding of the course material (1996, p. 160). Samsa and Oddone (1994), after teaching a course in statistically based scientific writing, concluded that "writing is an excellent mechanism for identifying students' strengths and weaknesses" (section 6, para. 2). Because writing exposes what students can and cannot explain, it also helps us discover what they still need to learn.

Most importantly, however, writing can improve students' statistical thinking and learning. Scholars in composition (Emig, 1977; and Berthoff, 1982; for example) and in WAC (writing across the curriculum) studies (Fulwiler, 1987; for example) have recommended writing as a way to develop and extend thinking. The American Statistical Association (2005) recommends written assignments as a way to assess statistical thinking. According to Grossman, Smith, and Miller (1993), when students write about statistics, "Writing becomes the means for translating the strange into the familiar and the seemingly foreign or new concept into a comprehensible or understandable idea" (p.2). Powell (1997) describes the usefulness of writing about mathematical experiences this way: "Writing, because the writer and others can see it, allows one to explore relationships, make meaning, and manipulate thoughts; to extend, expand, or drop ideas; and to review, comment on, and monitor reflections" (para. 11). Articulating thinking in writing, especially in informal writing assignments like learning logs or journals, can help clarify and extend that thinking.

Though there are many examples of informal writing as a teaching method in statistics, including journals, learning logs, dialogue journals, and informal writing turned in with homework, one of the two types of assignment in the current study consists of posts on a discussion board, and discussion posts are treated more often as verification of technology use than as a writing assignment in the literature. Comunale, Sexton, and Pedagano Voss (2001), for example, studied discussion boards as part of a larger study of the effectiveness of course web sites in a business statistics course. They found that students who used the course web site and found the discussion board useful also thought that the web site helped them learn. Krentler and Willis-Flurry (1999) found significant correlation between the amount of thoughtful posting a student did on discussion boards in a marketing course (with thoughtfulness assessed by the course instructor) and the student's learning (measured by course grades.) According to Marra, Moore, and Klimczak (2004), very little work has been done with content analysis of

discussion boards – that is, with looking at discussion board posts as writing, rather than evaluating user satisfaction or counting posts or numbers of words.

One problem, of course, is that it is difficult to decide whether learning has, in fact, taken place. Krentler and Willis-Flurry (1999), after pointing out that student reports of whether a tool helped them learn was an inadequate measure of learning, used course grades as their measure; it certainly can be argued that grades are a better measure than student reports, but neither one is complete. In the current study, we did look at course grades, in which we found no measurable differences, and we did also ask for students' self-reports (see findings below), but one of our main focuses was not on summative measures of learning, but instead on characteristics of student writing that may indicate a potential for student learning.

Methods

In the current study, students in two sections of the same introductory statistics course were given the same writing prompts, but asked to reply in two different ways. We relied primarily on the collection and qualitative analysis of the writing done by students, but also investigated students' response to the assignments with a final survey. We believed that the prompted writing would promote student learning and statistical thinking, whether they were writing journal assignments or participating in a discussion board. We hypothesized, however, that students would get more benefit from the discussion board, as it allows for interactive discussion, collaboration, and debate. We were also particularly interested in determining what kind of writing students were doing in each case.

Prior to this study, the Introduction to Statistics course at the college included a homework journal assignment that allowed the instructor to gauge students' understanding of the material, as well as to gain insight into how they were feeling about the course, and to adjust her instruction accordingly. Along with each homework assignment, the students would write a short paragraph in which they could ask questions relating to the content or the course as well as express their feelings about the course. This journal, however, did not specifically require students to think about, and write about, statistical content. Although journal writing has been shown to alleviate statistical anxiety, as has been noted, writing about more than just their feelings may also prompt students to think about statistics, so the instructor decided to create ten prompts, based on class content, to which the students would respond. Some of these prompts asked students to apply their new understanding of statistics to real-world applications. Table 1 contains four examples of prompts used. Some of the prompts, the first and third in the table for example, asked open-ended discussion questions about statistics, and others, like the second, asked students to apply the new concepts they were learning.

The fact that the instructor taught two sections of Introduction to Statistics created an opportunity to compare two different methods of asking students in each of the two sections to respond differently to these prompts. In one section, all the students would simply write a 250-word journal response to each prompt and turn it in on a weekly basis. In the other section, all the students would answer the same prompts by participating in discussion forums in Blackboard. For the latter method, which placed an emphasis on the use of technology, each student was required to post an initial response to the prompt as well as at least one response to another student. The course structure for the two sections was identical in all other ways.

Across the two sections, 38 students participated in this study. Out of the original 23 in the discussion board section, 3 stopped coming to class, and 2 declined to participate in the study, leaving 18 participants. Of the original 24 students in the prompted journal section, 2 stopped coming to class, and 2 declined to participate in the study, leaving 20 participants. Each section had both high achieving and low achieving participants. A t-test of final course grades yielded no significant difference between the two sections (t = -0.20, p = 0.84)). Herein, the discussion board section will be referred to as Section A and the prompted journal section as Section B.

Table 1
Some of the Prompts Used for Journal Assignments

Example	Prompts
Example 1	What does "statistically literate" mean and why is it important to be "statistically literate"?
Example 2	Get on to the Gallup Poll website (via External Links). Pick one of the articles (there may only be one that you can access) and discuss one or two of its results. There is no need to discuss all the results. Be sure to describe the survey methods. What does 95% confidence mean?
Example 3	The numerical aspect of statistics can be described as "numbers with social context." What does this mean to you?
Example 4	Charts and graphs are seen quite frequently in newspaper articles, magazines, books, etc. There are pros and cons to using such visual representations. Describe one pro for using a chart or graph. Describe one con.

Table 2
Items on the End-of-Semester Surveys

Question	Section A: Discussion Board	Section B: Prompted Journal
1)	I believe that participating in the Discussion Board forums on Blackboard was beneficial to the learning process.	I believe that writing the prompted journals was beneficial to the learning process.
2)	I enjoyed participating in the Discussion Board.	I enjoyed writing the prompted journals.
3)	I would recommend that the Discussion Board be a permanent part of MAT 2021.	I would recommend that the prompted journals be a permanent part of MAT 2021.
4)	The Discussion Board WAS NOT too much extra work in addition to the other course requirements.	The prompted journals WERE NOT too much extra work in addition to the other course requirements.
5)	I would have preferred to write a weekly 250-word typed response to the prompts instead of participating in the Discussion Board forums.	I would have preferred to participate in forums in the Discussion Board in Blackboard instead of writing the weekly 250 page typed response to the prompts.
6)	Reading other students responses helped me to think about statistics in a different way.	I believe that being able to read how other students responded to the prompts would have helped me to think about statistics in a different way.

All journal assignments and discussion board entries written by participating students were collected and analyzed. The analysis began after the semester had ended and some time had passed, when both investigators independently re-read and coded journals and discussion board entries, and then met to discuss patterns identified and further questions to ask. In a content analysis of qualitative data, it is expected that the data itself will provide some of the coding categories and that the identification of these categories which arise from analysis is, in fact, one of the important outcomes of the research. The categories themselves provide insight into the phenomena being investigated and point to opportunities for future research. In this research, we searched the writing samples, both prompted journals and discussion board dialogues, for types of writing that could be divided into clear categories.

At the end of the semester, participating students in each section were given a short survey which used a Likert scale. Table 2 shows the items for each section.

The statements on the two surveys were worded slightly differently in order to relate to the discussion board or the prompted journals, but the items matched up one to one, which can be seen in Table 2 by reading across rows; for example, Item 1) for section A is about discussion boards and learning as they posted their responses, whereas Item 1) for section B is about journal entries. It should be noted that not every student responded to every item.

Findings

The writing assignments in both sections appear to have value as tools for teaching statistics. One difficulty in attempting a comparison of the two types of writing is that they are very much two different types; the rhetorical situation in a discussion board is entirely different than the one a writer is in when she writes a journal assignment she knows will only be read by the teacher. Particularly key is a primary difference between discussion board posts and journal entries: the audience of a journal entry is perceived by the writer to be the professor, or in rarer cases, the writer himself, but the audience of a discussion post is much broader. Audience makes a difference in many aspects of student writing.

Accordingly, when we analyzed the students' writing for themes, we actually arrived at two overlapping sets of themes for the two types of writing. One theme found in both sets of writing samples was example. Students used examples, both short and extended, to illustrate the statistical concepts they were writing about. Student writers pulled examples from the world as they see it. For example, in answer to the question, "What does it mean to be statistically literate?" one student posted, "Statistics are used all around us: the car insurance companies use statistics to figure out [whom] to charge what, the sports teams determine their players' salaries with statistics, [and] colleges use statistics to determine how they can attract more students." Another student used marketing firms as an example in a journal entry, writing, "Often marketing firms or political groups will do this to make their cause seem better and their opponent's worse. It is not misrepresenting the data, but transforming the way it is viewed…" Concrete examples appear to be a way that students can pin down knowledge about statistics for themselves, and in the case of discussion posts, for their classmates, through their writing.

A second theme found in both sets of writing samples was personal connections. Students made personal connections to the concepts they were writing about in both their journal entries and in their discussion board posts. These personal connections may help students become more engaged. For example, students asked to investigate the Gallup poll web site will choose to write about polls to which they feel some connection. One student wrote in a journal response, "I had a deep interest in the brief section on sham

surgeries involving experiments on Parkinson's disease. My grandfather has Parkinson's, so it caught my eye." Another posted that, "My math teacher from high school worked for the state in the summers, and he took his class on a field trip so that we could actually see this at work. This is the first time it dawned on me that numbers could be so loaded with meaning." These personal connections are an important theme in the data because of the way people learn: ideas and concepts that can be linked to already existing interests will make more impact.

A third theme was questions, though students asked far fewer questions than we expected; questions were found predominantly in the discussion board. It may be that students asked questions less frequently in their journal entries because, even though they knew their instructor would be reading and returning the work, the answers were likely to be delayed by several days. A student writing in a journal entry, for example, "…the statistics book mentions tossing a coin to choose a simple random sample, is that the right thing to do?," is probably expecting a response, but not a quick one. On the other hand, the student who posted, "I don't understand the part about seventeen polls taken over a period of three months. Were they all the same questions done by the same pollers?," on the discussion board knew that even the instructor did not respond right away, a classmate might. The prevalence of questions in the discussion board, versus a relative paucity in the journal entries, is one place where the difference in audience may be playing a role.

The writing that students did on the discussion board showed a wider range of types of writing. One theme in the data from the discussion boards was validation. Students often validated one another's responses through praise, agreement, and restatement. When students wrote, "Wow...that's crazy…but interesting," or "I think your topic sounds interesting," they were validating with praise and expressions of interest. They also validated by agreeing with their classmates, as in, "I think this is true," or "I agree with your response," and through praise: "I thought that your response was very observant…Good point, really added to the discussion." Students also frequently re-stated one another's contributions and sometimes expanded on what others wrote, as when a student posted, "I think this would be an interesting topic to run a survey on. You could find out if people went to places around the world with their parents or actually set off by themselves. You could also compare where people live and where they have traveled to."

Another theme that arose in the discussion boards and not in the journal was debate. In the discussion boards, students occasionally corrected, or debated, other student's contributions; for example, one student wrote, "I didn't read the poll you responded to, but wouldn't a voluntary response survey be one in which the people called in to give their opinions not the other way around?" Because the journal entries had such a narrow audience and were written only in response to the prompt, and never in response to another student's ideas, these themes of validation and debate were not found in the journal writing. An important value of the discussion board, in fact, seems to be that the students were engaging in a dialogue. When students became engaged in responding to one another about the topic at hand, they appeared to be able to extend the whole group's understanding of statistics.

Nudging or extending another student's understanding of statistics doesn't necessarily take a long response. One student might, for example, re-phrase what a classmate says using statistics vocabulary and thereby help the first student, or perhaps even others in the class, become more comfortable connecting that vocabulary to already existing schema. For example, regarding the use of graphs in general publications, one student wrote the following:

> There are plenty of pros and cons of using graphs. When they are used in magazines, newspapers, and other media related documents, they can be very misleading. The information that they represent may be the truth, but the information that is presented in the graph may not be what they are really trying to prove. The anti-tobacco [ads] are very good for this. [They] use graphs to show how many people [die] each year from smoking, but they never [seem] to show how many people actually smoke overall; therefore, their information should be presented differently.

Another student wrote this in response:

> I thought that your response was very observant. I had never even thought about the fact that they have all these statistics about smoking, but have never stated the sample size or the population size that they are using. Good point, really added to the discussion.

Here we see the second student not just validating the contribution of the first with "very observant," and "good point," but also rephrasing the example about anti-tobacco advertisements using the terms "sample size" and "population." We can't know, of course, whether the second student is using the terms because she is experimenting with them herself, or because she wants to help her classmate learn them (which would be perhaps more altruistic a motivation than most students might have!), but one way or the other, the collaboration serves to create a co-authored text that

encapsulates one part of the growing knowledge of the group.

In the following exchange, several students worked together to clarify terminology they have learned in class. One student wrote a post about a Gallup poll in which she brought up a concern about whether the poll was flawed because it was a voluntary survey, of which this in an excerpt:

> In three weeks time Bush's approval rating has increased from 51% to 57%. This was found by conducting a telephone survey of 1,010 american [sic] adults over the age of eighteen… This was a telephone survey which can make the results bias [sic] because not everyone has a phone. Also it is a voluntary survey which usually people who only care about the topic answer. 95% confident means that 95% of the time Gallup falls within the M.O.E.. They are 95% confident they are within the M.O.E.

Another student responded by tactfully questioning the first student's use of the term "voluntary survey": "I didn't read the poll you responded to but wouldn't a voluntary response survey be one in which the people called in to give their opinions not the other way around?" This question may be the writer's gentle way of correcting the first student. A third student chimes in with a reinforcement – "This was also my understanding, thank you for bringing it up" – and then a clarification or re-phrasing of the first respondent's correction:

> I thought that the selection of telephone survey participants was random and that any non-answer was factored in as part of some math business. That if someone did not participate then they were a loss, and Gallup could not choose another participant. Right?

The value of the journal entries seems to be that the students are able to engage in reflective thinking about statistics. When asked to respond to the journal prompts, students asked questions, created their own examples of key concepts, connected the material to their prior knowledge, and corrected their understanding as they wrote. But when students wrote to one another and then wrote responses, there seemed to be added benefits. The re-phrasing function of student responses was key to the social construction of knowledge that appeared to happen in the discussion board exchanges. In addition, there were several conversational features here which demonstrated that during this discussion, knowledge was experienced by the students as negotiable. The writers couched corrections as questions, qualified their contributions with phrases like "I didn't read the poll you responded to, but…," as well as invited correction and rephrasing with questions like the "Right?" at the end of a student's response.

This re-phrasing and negotiation were qualitatively different than simply asking the teacher for a definition or clarification, and they may have helped student writers as they constructed their own growing knowledge. At the same time, the teacher was able to read the discussion, at her convenience, and intervene when it seemed that a little nudge might help. For example, here the teacher added a fairly long explanation of the term "voluntary response." Although there was surprisingly little misuse of statistical vocabulary in either the discussion board or the journal entries, the journal entries allowed the instructor the opportunity to correct what misuses there were. In the discussion board, however, because the instructor's contribution came after the students' discussion, and because it responded to the students' concerns directly, it became part of the negotiation context, rather than simply instruction aimed at filling a student's head with the right answer. The discussion board also offered another advantage: speed of intervention. Both forms of writing allowed the instructor to "take the pulse" of the class, to see where the group as a whole might need more instruction. "In class, I talk about misconceptions," the instructor reported, "and I also correct them on papers." But the discussion board allowed intervention the next time she logped on, so that misconceptions could begin to be corrected more quickly.

More Findings: Survey Results

The survey at the end of the semester provided insight into how the students viewed the writing assignments in the context of their introduction to statistics and their learning in the course. Table 3 summarizes some of the results of the survey, comparing how students from the two different sections, the A section that wrote on the discussion board and the B section that wrote journal entries, responded to statements in that survey.

In our study, more students appeared to enjoy the discussion board than the solitary journal writing. In Section A, 56% enjoyed participating in the discussion board, while in Section B only 40% of the students enjoyed writing the prompted journals. Only two students in each section, however, indicated they did not enjoy the activity. A majority of the students thought the writing assignments were worth keeping. Sixty-seven percent of the students in Section A would recommend the discussion board become a permanent part of the course. In Section B, 55% recommend keeping the prompted journals.

Table 3
Percentages of Students Who Responded "Agree or Strongly Agree" to Selected Statements from End of the Semester Survey

	Section	
Item	A: Discussion Board	B: Journals
Enjoyed writing assignment	56	40
Recommend writing assignment become a permanent part of course	67	55
Writing did not add too much extra work	82	74
Participating in the discussion board was beneficial to learning	61	50
Would have preferred the other type of written assignment	6	33
Reading other students' responses [might have] helped think about statistics in different ways	72	53

A major concern for many instructors trying to introduce more writing into their courses is the workload that it adds, both for instructor and for students. However, 82% of students in Section A indicated that the discussion board did not add too much extra work, and only one student indicated that the discussion board was too much extra work; 74% of students in Section B indicated that the prompted journals did not add too much extra work. Most of the students surveyed agreed that the writing assignments did not add excessively to the course workload.

Perhaps more importantly, most of the students felt that the addition of writing to the course was beneficial to their learning. In Section A, 61% of the students agreed or strongly agreed that participating in the discussion board was beneficial to their learning, and fewer than 6% disagreed. In addition to the six statements using the Likert scale, students were asked for general comments, and some of the narrative comments in this section may provide some specifics about why the students saw the discussion board as beneficial. One student wrote, "It seems like a lot of busy work, and time consuming but in the end it paid off." Another commented that the discussion board posts "were actually quick and easy and helped my understanding of the material." It's important that writing in a math or statistics course be more than busy work; at the least, it should give the students practice communicating about the subject material, but if it can also help them learn or understand the course material, then it truly is not "busy work," and worth integrating into the course. Seventy-two percent of the students in Section A indicated that reading other students' responses helped them think about statistics in a different way.

Journal entries were not seen by students as being quite so beneficial. In Section B, only 50% of the students agreed or strongly agreed that writing the prompted journals was beneficial to their learning, and 25% of the students in Section B disagreed. And although one student wrote, "Journals were not too difficult; they helped me learn the material," and another commented that, "I think it is good to have prompted journals because people learned more," there were fewer positive narrative comments overall (two positive and two somewhat positive, versus the six strongly positive comments in the other section), and some students were downright disenchanted. One student in this section commented that the journal assignments "seemed tedious," which is a far different attitude than the one expressed by the student in the other section who said of the discussion board assignment, "Love it!"

When asked if they would have preferred to write prompted journals, 94% of students (all but one) in Section A indicated they would not. In contrast, only two-thirds of the students in section B indicated they would not have preferred the discussion board. Four students in the latter section actually indicated they would have preferred the discussion board. For this survey question, a non-parametric test was used to compare student responses in Section A to student responses in Section B. The results of this analysis support the overall preference for the discussion board.

Lastly, 72% of students in Section A believed that reading other students' responses helped them to think about statistics in a different way. Even without having the opportunity to share their thoughts with their follow students, 53% of students in Section B believed that having the opportunity to read other students' responses would have helped them think about statistics in a different way. Table 4 shows the results of non-parametric Mann-Whitney U tests on each of the six survey questions

Question 5, regarding the preference for the typed journal responses versus the discussion board, was the only question to show statistical significance. It should be noted that for each survey item, the responses of students in Section A were overall slightly more positive. While most of these differences were not statistically significant, it does lend support to the authors' hypothesis.

Table 4
Mann-Whitney U Test on the Survey Questions

Question #	*U*	*Exact p-value*
1	154	.422
2	158	.495
3	145.5	.281
4	108	.069
5	80.5	.004
6	137.5	.283

Discussion

Asking students to write in a statistics course does, of course, add to the instructor's work load (Stromberg & Ramanathan , 1996). We believe that the writing we saw students doing during this study, however, justifies the extra work for the instructor. The grades in the two sections were representative of previous semesters' grades, and this study did not attempt to measure actual learning or achievement, but it is clear that both forms of writing allowed students to engage in reflective thinking about statistics and to communicate their questions to their instructor. The discussion board, in addition, engaged students in a dialogue, which allowed them to build on one another's thinking. It is probable that both forms of writing helped students to improve their understanding of mathematics and their ability to communicate mathematically.

The differences in achievement between the two groups were not clear enough to indicate that one type of assignment is preferable to the other. In terms of actual grades in the course, on average the two sections didn't differ significantly. Section A, the discussion board section, performed better overall on Test 1 and on the final exam. On Test 2, Section B very slightly outperformed Section A. We feel, however, that the project was beneficial, both for the students and for the instructor. It is evident that overall, the students believe that they benefited from the process of writing in their statistics course.

The journal entries were typically longer than the discussion posts and replies, partly because the instructor set a required length for that assignment and not the other. The required length may have allowed for more extended individual thinking. The type of discussion that happens in the discussion boards, however, because it allows students to build on one another's thinking, by providing examples, correcting when necessary, or connecting to already existing knowledge, may be more valuable in some ways than the solitary journal writing read only by the teacher. It provides the students with validation from their peers, building their confidence as statistical thinkers during the process of the actual thinking. The survey data also shows an overall preference for the discussion board over the prompted journals. The instructor is planning on continuing to use the discussion board in future sections of Introduction to Statistics.

The analysis of writing in the statistics course presented here shows that writing assignments prompt students to articulate their increasing understanding of statistics in several important ways. Both the journal entries and the discussion board posts show evidence that students are able to articulate some of the concepts they are learning in the statistics course, to produce examples, and to connect those concepts to their own lives. In addition, the discussion board writing allows students to interact and to negotiate meaning in a social context, which may further their learning even more. Students also feel that the discussion board assignment helps them learn the material. Because writing in the statistics course appears to help students learn, it would seem important to continue to find ways to integrate writing into statistics instruction and to further evaluate its effectiveness as a pedagogical tool.

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Theoretical and Practical Issues in Team-Teaching a Large Undergraduate Class

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Attempts by universities to provide an improved learning environment to students have led to an increase in team-teaching approaches in higher education. While the definitions of team-teaching differ slightly, the benefits of team-teaching have been cited widely in the higher education literature. By tapping the specialist knowledge of a variety of staff members, students are exposed to current and emerging knowledge in different fields and topic areas; students are also able to understand concepts from a variety of viewpoints. However, while there is some evidence of the usefulness of team-teaching, there is patchy empirical support to underpin how well students appreciate and adapt to team-teaching approaches. This paper reports on the team-teaching approaches adopted in the delivery of an introductory journalism and communication course at the University of Queensland. The success of the approaches is examined against the background of quantitative and qualitative data. The study found that team-teaching is generally very well received by undergraduate students because they value the diverse expertise and teaching styles they are exposed to. Despite the positive feedback, students also complained about problems of continuity and cohesiveness.

Growing public criticism of the quality of teaching in higher education has led universities to adopt and promote better ways of enhancing students' learning experience. Over the years, the focus on higher education research has shifted from an understanding of the teacher as the omniscient authority who transmits knowledge to passive recipients to a more inclusive appreciation of students as knowledge constructors and the need for teachers to act as facilitators in that process (Biggs, 1999). In the context of providing a more constructive environment for students and the best learning experience possible, universities have increasingly been promoting the concept of team-teaching (Wenger and Hornyak, 1999). In simple terms, team-teaching aims to expose students to specialist knowledge of a variety of staff members, as well as exposure to current and emerging knowledge in different fields. Team-teaching also aims to facilitate students' understanding of concepts from a variety of viewpoints. The objectives that inform team-teaching approaches are designed to encourage a cooperative effort in which students and teachers are engaged in an intellectual exchange that ultimately benefits both parties. This is also based on the understanding that topic expertise would be broadened and classroom time for teachers reduced (Wenger and Hornyak, 1999).

The vast majority of the literature on teaching and learning at tertiary education level suggests that a team-teaching approach is beneficial to both students and academic staff, despite a wide array of definitions of what actually constitutes team-teaching and how it is evaluated (Anderson and Speck, 1998). This article discusses the particular team-teaching approaches adopted by three academic staff at the University of Queensland (Brisbane, Australia) in the delivery of an introductory journalism and communication course (JOUR1111) in the first semester of 2007. As there exists a "cacophony of voices" (Anderson and Speck 1998, p. 672) in regard to the definition of team-teaching, the authors outline how their particular approaches were applied in the delivery and teaching of the course. The article discusses discursively how the authors perceived their team-teaching approaches and compares the approaches with evaluative student feedback.

A number of scholars have emphasized that much research into team-teaching has been qualitative, therefore underlining the lack of empirical evidence (Anderson and Speck, 1998; Carpenter et al., 2007; Austin and Baldwin, 1991). This article aims to contribute to a growing body of empirical evidence through the analysis of quantitative and qualitative student feedback. It concludes by making recommendations for improving team-teaching approaches in the delivery of a large introductory university course.

Teaching and Learning at the University Level

The literature on teaching and learning at the university level underscores various reasons why lecturers and indeed university administrators should take teaching seriously. One of the reasons is that a symbiotic relationship exists between teaching and learning. For example, the modes of teaching adopted by lecturers in universities significantly affect the way students learn or the way students go about learning (Marton et al., 1997). This relationship also affects the nature of the learning approaches adopted by students – "surface" or "deep" approaches to learning. As

Ramsden (1992) stated: "Teaching and student learning are parts of the same whole;… Problems in learning may be addressed by changing teaching, but with no certainty of success" (p. 16).

In order to understand what teaching is all about, Ramsden (1992) posed some important questions: "What exactly is teaching about? What do we mean when we say we 'teach' someone something? What are the main problems we face in teaching? What methods should we use, and why? What helps our students to learn? What stops them learning?" (p. 13). Understanding these issues no doubt would facilitate an improvement in teaching styles and would also help students to engage with their studies. To understand why there are deficiencies in what students learn or, as Ramsden (1992) put it, "Why… students just come to classes to copy from the board?" (p. 37), it is appropriate to request students to talk about their learning and how it is influenced by teaching.

How Students Learn

In the higher education literature, there are two distinct and documented approaches to learning that are adopted by students. These are "surface" and "deep" approaches. In their seminal study, Marton & Säljö (1976) examined how students learned, and distinguished between two predominant ways of learning. The first one, the "surface approach", focused on a text or task itself, while the "deep approach" focused on understanding what this text or task was actually about. Or, as Ramsden (1992, p. 45) explained the concepts: "Surface is, at best, about quantity without quality; deep is about quality and quantity." To emphasize the close relationship between what students learn and the approach they take to learning, Ramsden (1992) states that "deep approaches are related to higher quality outcomes and better grades. They are also more enjoyable. Surface approaches are dissatisfying; and they are associated with poorer outcomes" (p. 53). Indeed, a number of studies have shown that deep learning approaches lead to improved, i.e. higher quality, learning outcomes in students (Dall'Alba, 1986; Prosser & Millar, 1989; van Rossum & Schenk, 1984). The implication is that if teachers want students to achieve higher quality outcomes in their studies, they must endeavour to steer students to focus on understanding the concepts and the subject rather than allow them to concentrate on completing task requirements or on merely passing the examination. This implies reflecting on, and reviewing and changing, teaching styles, including assessment tasks and materials, in such a way as to motivate students to develop deeper and sustained interest in their studies.

Although good teaching involves getting students to adopt "deep" approaches to learning, there are other factors that impinge on students' ability to adopt "deep" or "surface" approaches to learning. This is the educational context or environment. "The educational environment or context of learning is created through our students' experience of our curricula, teaching methods, and assessment procedures" (Ramsden, 1992, p. 62). For example, in relation to assessment procedures, Chalmers and Fuller (1995) state that "the most powerful single influence on the quality of student learning is probably the assessment system that is used…. [I]n order to encourage students to adopt a deep approach to their learning and to use appropriate learning strategies it is important to ensure that the assessment system supports the type of learning promoted by the teacher and the university"(p. 47). In this regard, Race (1995) recommends that teachers "make continuous assessment very 'real life'," that teachers "ensure that students have a say in the tasks they do, how they are assessed, who assesses," and that teachers "give more detailed feedback on work, not just scores" (p. 72).

Further, student workloads have an impact on how students learn. Using data from studies of adult part-time students of the arts and humanities in the Open University, Chambers (1992) argues that "'reasonable workload' is a pre-condition of good studying and learning" (p. 141). The implication is that "when teachers overburden students, demanding more work of them than they have time to do, they create conditions in which what is to be learned is likely to be unintelligible, and in which students cannot possibly learn well" (Chambers, 1992: 144). In essence, excess workload impedes deep approaches to learning: students are more likely to do just enough to pass an assessment task and not bother with eh question of whether or not learning has occurred at all.

This implies that, if a student is not interested in a particular task, he or she is most likely to adopt "surface" approaches to learning. In order to improve "deep" learning in students, universities have in recent years adopted a variety of strategies. One such strategy has been team-teaching, as it is believed that students can benefit from being exposed to a variety of specialist knowledge on related topics. One important aspect of deep learning is that it promotes thinking rather than memorizing. As such, the idea of team-teaching is that it can provide, among teachers, a space for intellectual discussions about a topic, thus providing unique insights for students in order to make them think about the topic rather than memorize information.

What is Team-Teaching?

There appears to exist some confusion over the use of the term team-teaching, and as a result a number of different definitions of the term exist. Firstly, team-

teaching appears to have many other names as well, such as co-teaching, co-enrollment, collaborative teaching, or cooperative teaching (Carpenter et al., 2007: 54). On a more general level, it seems to be accepted that team-teaching "consists of two or more teachers sharing, to some degree, responsibility for a group of students" (Wenger and Hornyak, 1999, p. 314). How this is applied, however, may differ in a variety of contexts. As Anderson and Speck (1998) point out, some see teams as being responsible only for instruction, while others see them as being involved in all aspects of a course. For example, Gurman (1989) defines team-teaching as "an approach in which two or more persons are assigned to the same students at one time for instructional purposes" (p. 275). Hatcher et al. (1996) see it as "two or more instructors collaborating over the design and/or implementation and evaluation of the same course or courses" (p. 367).

In addition, Carpenter et al. (2007) note that there are various grades of team-teaching, ranging from teachers dividing up lecture blocks between or among them (the serial approach) to teachers continually planning, presenting, and evaluating lectures together (the collaborative approach). The team-teaching approach gets more complex when one adds guest lecturers to the mix. Jacob et al. (2002) identify team-teaching as a method in which all instructors are equally involved and responsible for student instruction, assessment, and the learning objectives. Guest lectures, they note, are "usually an isolated occurrence within the context of a course taught predominantly by one person or by a small group of people" (Jacob et al., 2002, p. 3). There is little research on the value of guest lectures, especially as they are mostly one-off occurrences, and somewhat difficult to evaluate.

This paper reports on a team-teaching method using a combination of team-teaching and guest lectureships, which was adopted in an introductory journalism and communication course. The approach was implemented to enable the team to make use of the wide variety of expertise within the university's School of Journalism and Communication. This mixed-method approach was based on the assumption that a combination of instructors could produce richer learning experiences for students, such as exposing students to multiple perspectives (Carpenter et al., 2007; Hughes and Murwaski, 2001; Anderson and Speck, 1998). Results from this particular study will contribute more generally to existing empirical knowledge in the field of team-teaching, as empirical studies of this nature are still missing from the literature (Carpenter et al., 2007).

Justification of Team-Teaching Approaches

As noted earlier, the teaching approaches adopted in the delivery of an introductory journalism and communication course were designed to enable the team to engage more actively with the students in their learning, to help them to improve their learning skills, and, consequently, to assist them to achieve their learning objectives. All these were aimed to enable students to adopt deeper approaches to learning rather than surface approaches (thinking rather than memorizing) (see Ramsden, 1992), as well as to make the course more appealing to students. Other assumptions that influenced the teaching styles included

- students' ability to cope with workload associated with continuous assessments (in some cultures, students are assessed only at the end of semester, and often examination is the only means of assessment);
- motivational factors (that is, what makes the students to study in specific ways; for example, personal attributes, learning styles adopted in previous educational institutions, the requirements of particular courses, demands by parents, and so on).

Overview of the Course

All three authors were involved in delivering the introductory journalism and communication course (JOUR1111) in the School of Journalism and Communication at the University of Queensland during Semester 1, 2007. In that semester, the course achieved a record enrollment of 505 students, making it by far the course with the highest student enrollment in the School. Owing to the unexpected increase in enrollment closer to the commencement of semester, the course was offered in two iterations each week at short notice, as the largest available lecture venue could not accommodate such a large number of students. The main lecture was conducted every Monday at noon, with a repeat lecture on Friday at 2pm. Students were informed they could attend either the Monday or Friday lecture. The Monday lecture recorded the largest attendance, with more than 300 students on average attending each week, while a core group of around 35 students attended the Friday lecture.

In teaching the course, the team members were responsible for the planning, administration, and evaluation of the course content. The team also adopted approaches that were perhaps best described as a mix of serial and collaborative approaches (Carpenter et al., 2007). Each member of the team was responsible for

delivering at least two lectures, while the team also made use of the wide pool of specialist knowledge in the School by recruiting a number of staff members as guest lecturers. As this was an introductory course, the use of guest lecturers from the School was intended to expose students to a wide range of views on journalism and communication. This was in line with Carpenter et al.'s (2007) argument that "multiple instructors create a 'richer' learning environment, due to multiple perspectives and more effectively catering to individual learning needs" (p. 61). Almost each week the students were exposed to two one-hour lectures, conducted consecutively by a different lecturer for each hour. Tutorials were conducted by graduate students who were in close contact with the teaching team. Tutorials discussed lecture content but mainly concentrated on preparing students for assessment tasks. As this article focuses mainly on the team-teaching approaches in lecturing, tutorials and assessment have been excluded from the analysis of the results presented here.

Method

In order to analyze the success of the team-teaching approaches, a comprehensive evaluation of the course was conducted by way of questionnaires at the end of the semester. In a study of this nature, it was deemed important by the team members to use a combination of quantitative and qualitative research strategies in order to enhance the quality of data. Deacon et al. (1999) suggest that the use of qualitative and quantitative methods is necessary in order to collect and analyze more credible and valid data. Against this background, students were requested to respond to a total of 18 Likert-scale statements which tested their experiences in the course. The evaluation was the first team-teaching-specific questionnaire devised and used at the University of Queensland. Among other, more standard, evaluative questions related to feedback and assessment, this particular questionnaire also asked students to indicate their agreement with aspects of the team-teaching approach in the course. These included statements such as: "The team-teaching approach was effectively used in this course," "Team-teaching provided me with diverse insights into the course content," "The material covered by the different lecturers was well integrated," "The team-teaching method provided me with a valuable learning experience," and others. In responding to the statements, students were requested to choose between "strongly agree," "agree," "neutral," "disagree," or "strongly disagree". There was also an option for "not applicable."

In order to obtain some qualitative feedback from such a large number of students that would also be manageable in terms of data analysis, students were additionally provided with two open-ended questions. The questions were: (a) "What are the teaching strengths of the lecturing team?" and (b) "What improvements would you suggest?". It should be noted that these are standard qualitative questions as stipulated by the university, hence the authors felt some additional oral direction was required. Students were therefore requested to specifically address the team-teaching aspect in their answers to the two open-ended questions. Questionnaires were handed out and briefly explained to students by the authors before the authors left the room to guarantee confidentiality of results. Questionnaires were collected by a student volunteer who subsequently posted them to the university's teaching evaluation unit.

The central research questions that underpinned this study were

1. To what extent did students appreciate team-teaching approaches adopted in the delivery of an introductory journalism and communication course?
2. Which specific approach (or approaches) did students find most useful and which did they find least helpful in achieving their learning objectives?
3. How did students perceive the use of guest lecturers in delivering the course?

Analysis of Quantitative Results

A total of 245 questionnaires were completed and returned by the students. This constitutes a return rate of 52 percent (based on final enrollment number of 473 at the end of semester). Of those questionnaires, 217 were completed by students in the Monday class and 28 by students in the Friday class. Of the 18 statements in the questionnaire, 13 were selected for analysis because they related directly to the teaching strategies adopted in delivering the course. Statements addressing aspects such as feedback and consultation were not analyzed.

The rating of the teaching approaches adopted in the delivery of the course shows that, overall, the students rated the team-teaching methods well above average. As Table 1 shows, each item scored a mean of well above the Likert scale mean of 3.0. Further, more than 50 percent of students either agreed or strongly agreed with each item, demonstrating general support for team-teaching. The average rating for the team was 3.92 out of a maximum possible rating of 5.

In light of the large number of students who participated in the survey, this suggests an overwhelming endorsement by the students of the teaching approaches adopted in delivering the course and the contents of the course. It is important to point

Table 1
Quantitative Student Feedback

Statement	Mean (out of 5)	Standard deviation	% saying "agree"/ "strongly agree"
The lecturers seemed to know the course well	4.31	0.72	90
The lecturers produced classes that were well organized	4.16	0.75	84
The lecturers communicated their enthusiasm for the course	4.11	0.84	78
The lecturers involved in team-teaching were compatible	4.07	0.83	78
Teaching was well coordinated among the lecturers	3.97	0.93	75
The team-teaching approach was used effectively in this course	3.88	1.04	70
Team-teaching provided me with diverse insights into the course content	3.78	0.99	65
The lecturers emphasized thinking rather than just memorizing	3.77	0.90	61
The material covered by the different lecturers was well integrated	3.71	0.93	64
The lecturers presented material in an interesting way	3.71	0.96	62
Course continuity between the lecturers was good	3.66	0.99	59
The team-teaching method provided me with a valuable learning experience	3.59	1.08	54
All things considered, how would you rate the team's overall effectiveness as university teachers?	3.92	0.78	73

out, however, that the average ratings should not be interpreted to imply that all the students were satisfied with the team-teaching approaches. As shown later in this paper in the qualitative analysis of the results, some students were not happy with some aspects of the team-teaching strategies. For example, using the percentage aggregate for each item in Table 1, it is obvious that only a slight majority (54 percent) of students responded positively to the statement: "The team-teaching method provided me with a valuable learning experience." Similarly, 59 percent of the students approved the statement: "Course continuity between the lecturers was good". Although 64 percent of the students agreed that "The material covered by the different lecturers was well integrated," it is obvious that the percentage rating was not as high as the ratings received by other items in the instrument. The average rating of some items in Table 1, therefore, indicates clearly that more work needs to be done to identify other approaches that could be integrated into team-teaching in order to enhance students' learning experiences, as well as their approval ratings of the team-teaching approaches.

It is encouraging to note that more than two-thirds of the students who responded to the questionnaire (78 percent) agreed that, "The lecturers involved in team-teaching were compatible." Compatibility is very important in any teaching and learning activity that involves teamwork. If there is no compatibility among team members, students are likely to be confused about the objectives of the course, in light of the conflicting messages they are likely to be exposed to.. In addition, lack of cohesion and agreement among team members could leave students even more confused about the direction of the course, the material delivered in lectures and tutorials, and the assessment tasks in the course.

Equally encouraging was the agreement by 90 percent of the students that, "The lecturers seemed to know the course well." This is crucial. Team members' knowledge of a course is a confidence booster among students. Any perception by students that academic staff members involved in team-teaching lack in-depth knowledge and understanding of the basic theoretical and practical elements of the course would undermine students' confidence in the course and in the lecturers, including the perceived value of the course to the students. Surely, no one wants to learn from someone who has no clear idea about what she/he is teaching.

The literature on teaching and learning at the university level suggests that lecturers' knowledge of a course is not enough to ensure that learning has taken place. In essence, how knowledge is communicated is also critical to how students learn. For example, knowledge and ideas could be communicated in such an uninspiring and boring way that the methods of delivery would undermine the end purpose of teaching. It is important for lecturers to be able to communicate to, and share knowledge with, students in an interesting, more effective and engaging manner. This also implies

engaging in learning activities that promote, among students and lecturers, critical and mutual understanding of issues. It is in this context that one must note that 78 percent of the students who completed the questionnaire agreed that "The lecturers communicated their enthusiasm for the course." However, when one examines students' rating of the way that lecture material was presented, the results show that only 62 percent of the students agreed that "The lecturers presented material in an interesting way." Obviously this implies that team members need to work constantly on developing interesting ways of engaging students with the lecture material.

Qualitative Student Feedback

In order to provide a more qualitative dimension to the empirical data, responses from open-ended questions were examined by coding them into categories for comprehensive analysis. Answers were grouped in terms of dominant themes and analyzed in terms of similarity or differences. The dominant themes emerging from the analysis centered around the team's combined expertise, the diversity of views within the team, individual lecturing styles, and continuity among lectures.

In terms of perceived positive aspects of team-teaching, it appears that a vast majority of the students appreciated the approach, as it exposed them to a wide range of perspectives, offered expert knowledge on different topics, and gave them a holistic introduction to journalism and communication studies at the university. In fact, the categories "expert knowledge" and "diversity of views" were by far the most frequently mentioned categories by students in their qualitative feedback, receiving 45 and 43 mentions respectively. The above categories emerged from an analysis of student feedback on the question: "What are the teaching strengths of the lecturing team?"

The category "expert knowledge" was developed through answers such as: "people who were really qualified in the area they spoke on"; "there were 3 different fields of study the lecturers specialised in. The enthusiasm, the 'knows their stuff' factor, the broadness of topics covered… every desirable aspect in a lecturer was multiplied by 3!" and "The team had a good mix of lecturers with expertise in various fields, thus providing a holistic insight into the basics of journalism." Other issues mentioned by the students included: "Diversity: each week a different lecturer presents the lecture, so students are provided with a broader diversity of insights." This suggested students' endorsement of the use of guest lecturers in delivering the course. Also, another student noted that the "specialization and familiarization within individual fields covered" gave "strength to the presentation of each specific area of discussion."

In terms of an overall introduction and overview of the field of journalism and communication, the combined team-teaching and guest lecturing approaches seemed to be very successful in terms of providing students with expert insights. For example, one student said: "The team had a good mix of lecturers with expertise in various fields, thus providing a holistic insight to the basics of journalism".

In terms of the diversity of views, students appeared to appreciate listening to different lecturers every week, thus reinforcing the use of guest lecturers. This diversity begins on a rather mundane level of not listening to the same person week in and week out ("The different faces made it interesting") to a much deeper level ("More lecturers meant more and differing insights into concepts"). Another student noted that guest lecturers "made it interesting so it wasn't coming from one person all the time". Yet another student noted that the "teaching styles are very different which complemented the delivery of the material as it made it interesting and fresh to learn".

The fact that team members enjoyed working as a team and coordinated the course obviously also came across in students' responses. As Anderson and Speck (1998) noted, it is important in team-teaching that the team be a cohesive and compatible unit. From the perspective of this particular team, the members felt they worked as a cohesive and compatible team. A number of students seemed to notice this aspect, indicating that the team "worked well together, provided clear explanations and effectively involved the students through interesting methods of communication." Similarly, one student said: "The lecturers were able to work well as a team presenting interesting topics, week to week. They all seemed to know the course well and all expressed much enthusiasm." Another student noted the diverse backgrounds of the team members and "evident enthusiasm and experience in the field and the energy with which they communicated with each other and the obvious respect and appreciation they showed towards their colleagues." This highlights the fact that the team members were successful in attempting to foster a learning community founded upon respect for, and trust in, all the course participants. The team members emphasized cultural and gender diversity through their multicultural experience. In fact, the team members believed that cultural sensitivity and respect not only shaped more fruitful in-class discussions but also endowed students with a more critical reception of the assigned materials.

Negative Aspects of the Team-Teaching Approach

While responses to the open-ended questions in the survey were overwhelmingly positive, there were nevertheless some negative responses, which the team members considered useful to highlight in order to provide guidance for future team-teaching projects. The dominant negative comments centered on an issue that had also received a high number of positive feedback, namely that of individual lecturing styles (19 mentions). The second issue was about the level of continuity among lectures (16 mentions). The concern about the level of continuity resonates with the existing literature on team-teaching, particularly in terms of approaches to sequential teaching (Jacob et al., 2002).

As noted above, a large number of students appreciated the wide variety of guest lecturers and their backgrounds because they believed the two elements offered them a broad overview of the topics, the different teaching styles adopted by different lecturers, and insights into the lecturers' backgrounds. However, while most students appreciated these differences, some were critical of the quality of some lectures, which they felt did not reach the level of other lectures. For example, one student said: "Some of the guest lecturers failed to engage the students well, because of the content of their lectures and also their delivery. Some were boring or hard to understand." Another student noted that some lecturers "were not as engaging, whether it be through the tone of their voice or display of enthusiasm". One student said while the mix of lecturers was good, s/he would have preferred that the team used the same lecturer more often.

This last issue raised another concern, that of continuity among lectures, which was mentioned by a number of students. It also reflected what other scholars, such as Jacob et al. (2002) and Anderson and Speck (1998), pointed out, namely the need for team-taught lectures to be integrated very well and presented in one cohesive unit. Student comments in this area included: "Sometimes it felt as though the topics were disjointed and connections or links were made between two different topics"; "Sometimes the guest lecturers didn't deliver along the same lines as the lecture team." One student was very critical: "Guest lecturers interrupt the flow significantly, it becomes confusing". These critical comments suggest that, although a significant majority of the students endorsed the use of guest lecturers, a few students did not quite approve of the practice.

While cohesiveness and continuity can be controlled more effectively in a small team, they are much more difficult to control when one adds a large variety of guest lecturers to the mix. It should be acknowledged that each lecturer brings to a given topic his or her own background, his or her own understanding of the topic and also his or her own unique teaching styles. Each of these lecturers may be attuned to different understandings of teaching styles. For example, some lecturers may use a transmission model in their lecturing style, while others may adopt a more engaging and interactive teaching style. It is important to mention that every guest lecturer was briefed in-depth about the team members' expectations and the proposed contents of the lecture. The team members believed, to the best of their knowledge, that all guest lecturers delivered insightful overviews of their topics to students. However, it must be acknowledged also that it is beyond the power of team members to control or influence each guest lecturer's long-held tradition of lecture presentation. All guest lecturers were colleagues of the team members, and it was a sensitive issue for the team members not to be perceived as trying to nudge each guest lecturer toward a particular or preferred mode of lecture delivery. In addition, team members did not believe that differences in teaching styles were ultimately bad. It was also important that the team members recognized the observations of a majority of students who said they appreciated the variety of teaching styles brought by different guest lecturers. The adoption of different teaching styles in a team-taught course and the use of guest lecturers remain important issues for further reflection in planning team-taught courses as well as when using guest lecturers.

Conclusions

The results of the study reported here show there are evidently certain aspects of team-teaching that enhance students' learning experience which students appreciate. The results indicate that students responded well to most of the team-teaching strategies adopted in delivering the introductory journalism and communication course. On the basis of available evidence, this paper argues that team-teaching in the first-year introductory journalism and communication course was generally successful owing to a combination of factors: a mixture of team-teaching strategies and the use of guest lecturers, students' exposure to a variety of guest lecturers from a variety of backgrounds and a variety of teaching styles, and students' introduction to broad overviews of topics as well as the pool of academic staff within the School. Overall, the data suggest that students responded well to the team-teaching approaches and it would seem an appropriate strategy to replicate in teaching a first-year undergraduate course with a large student enrollment (example 500 and above).

Regardless of the positive comments provided by the students, however, it is important to note some aspects of team-teaching of which students were

critical, and which some may have found not very helpful in achieving their learning objectives. Some of the issues include differences in lecturing style, differences in quality of lecture contents, and the perceived lack of continuity and cohesiveness in lecture topics. It is recommended that these issues should receive priority attention in planning team-taught courses. While there are problems associated with trying to instruct one's peers about how to deliver lectures, there are also ways to overcome the problem, such as advising the guest lecturers about the need to engage the students through use of practical examples and humor. In light of the fact that a majority of the students endorsed the use of guest lecturers, we advise against completely eliminating the use of guest lecturers. There are consequences for discontinuing the use of guest lecturers. Eliminating the practice completely in team-taught courses would deny students the useful experience of being exposed to lecturers from different backgrounds, different teaching styles, and different areas of expertise. These issues need to be carefully examined in future planning of team-taught courses. Although Anderson and Speck (1998) argue that, while it may be desirable for team-teachers to have different styles of teaching, it is still important, nevertheless, to present a cohesive and compatible unit and not to give students mixed messages.

It is important to be mindful of the issues raised by Anderson and Speck (1998), including the argument made by Wenger and Hornyak (1999) that, often, the goals of team-teaching are "to broaden topic coverage, share the workload, and perhaps reduce class time for individual members. The students are exposed to multiple experts" (p. 314). However, in a deep learning context, Wenger and Hornyak (1999) warn that, while team-teaching has the potential to widen subject coverage, it also misses an opportunity to deepen the topic under discussion. This argument resonates in the qualitative feedback reported in this study, especially comments from students who criticized a lack of cohesion in the teaching format adopted in delivering the introductory journalism and communication course.

Overall, the experiences gained from the team-teaching strategies implemented here, in addition to the experiences gained from interacting with a large number of students from different backgrounds, have contributed to and enhanced the knowledge and understanding of the theoretical and practical issues associated with teaching and learning at the university level, including issues involved in teaching a large class in a first-year introductory course.

In conclusion, it is important to emphasize the usefulness of a much more holistic approach to teaching in which students and teachers are not only present in the classroom with their intellectual abilities, but as individuals with different experiences and backgrounds. Mutual respect, honesty, willingness to explore issues, open-mindedness, and a genuine concern for learning are key principles that remain important.

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The Conflicts Between Science Research and Teaching in Higher Education: An Academic's Perspective

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Academics are now expected to manage increasingly demanding research, administrative, and teaching obligations. These demands in practice mean that the pressures to balance teaching and research duties render cultivating links between the two activities a less-than-intuitive process. The author describes the difficulties faced by academics in the United Kingdom, students' learning experiences and perceptions of quality higher education, and the ways these issues relate to modern society's expectations of what University education should achieve. The author also considers how these issues are currently received and managed by Universities. To provide good quality higher education to the next generation, government and Universities should work together to address disparities and fill gaps in the research-teaching nexus. The evidence points to an urgent need to confront issues in a way that will benefit students, academics, Universities, and society. A non-exhaustive list of proposals described here aims to reverse the current trends that pull research and teaching apart. Such policies should be implemented, either on a national basis, or by individual Universities and should reflect the educational philosophy and cultural outlook of each institution. Ultimately a positive "nexus" may have potential benefits for both science research and teaching in the United Kingdom.

The term "research-teaching nexus" was first defined by Neumann (1994, p.323) and is termed to mean the relationships and links between discipline-specific research and student teaching and learning. This area encompasses a number of issues that involve benefits as well as conflicts between research and teaching. One issue is time management: balancing quality research and teaching duties by busy academics. Of noted importance are the various influences of staff research on the undergraduate teaching delivered. The term also incorporates the impact of government, institutional, and academic department policies on the form as well as the quality of the relationship between research and teaching. Nexus is also meant to include the importance of institutional or departmental curriculum design to student experiences and learning in higher education. Finally, this nexus includes the relationships between academics, Universities, and students: how these are shaped by and, in return, influence modern market forces and the ever-increasing pressures for measurable output and achievements. In this study, using an academic's perspective, I concentrate on describing the tensions that are felt by science academics in their quest to deliver quality in all aspects of their roles, and I suggest how in the current political and cultural academic climate, research and teaching links can be cultivated.

From the Points of View of All Concerned

Education experts have argued that the relationship between research and teaching should be a positive one. Ramsden (2001, p.4) has said: "I believe that the main hope for realising a genuinely student-centred undergraduate education lies in re-engineering the teaching-research nexus." However, one size does not fit all, and there are evident disparities amongst different disciplines on how this can be achieved. Research work suggests that natural sciences harbor a more specialised research culture, which may be more difficult to translate and relate to teaching (Rowland, 1996), and therefore making the research-teaching relationship a positive experience for teachers and students may be a challenging endeavour by nature. The last 60 years have seen social, political and cultural changes that have impacted the way higher education is conducted today. These changes have had a fundamental impact on how science research and teaching relate and are conducted in UK Universities. Below, I describe the experiences for all who feel the impact of these changes and can benefit from a fruitful relationship between teaching and research.

Influences by Modern Society and Government Policies

A number of studies clearly point to the demands modern market forces have placed on Universities to train research-minded and research-contributing professionals (Wieman 2004; Garrick and Rhodes, 2000; Zetter, 2002). Indeed, modern society and the new global market-driven economy have much to benefit from Universities: from the production of a skilled workforce, to the discovery of new products and medicines to enhance quality of life, to raised expectations in health and patient care. A number of forces have contributed to the pressures currently felt in

academic life and have defined the path of science research and teaching through the later part of the 20th and into the 21st century. The emerging emphasis on world health issues has prompted widespread government-sponsored programmes and driven the expansion of a large international pharmaceutical industry, with the creation of new jobs demanding a wide range of scientific skills. These forces together with the post-war social and economic prosperity have contributed to a vast expansion of scientific research and demand for better healthcare and treatments for many ailments (Scott, 1998). The demand for skilled professionals has also increased the number of students seeking to gain science-related University qualifications.

Responding to the changing economic market forces, consecutive UK governments have outlined policies to expand the student population in all disciplines. This has enhanced social integration and promoted diversity in the student population, changing the culture in student life and experiences in University education, promoting a more market-driven educational system (Johnston, 2004). As this expansion is continuously taking place, great pressures are placed upon Universities to excel in both research and teaching to attract the best talent and to produce graduates with market-relevant knowledge and skills. These pressures are then transferred to academic staff that must produce value for money in both research and teaching for their organisation.

A formalised process of assessing the quality of research conducted in the UK was implemented in 1986, in the form of the Research Assessment Exercise (RAE) ratings system. This was conducted to develop an objective measure to assist the distribution of research funding allocated to Universities by the UK higher education funding bodies. A total of 6 RAE exercises have been conducted so far, jointly by the national funding councils of England (HEFCE), Scotland (SFC), Wales (HEFCW) and the Department for Employment and Learning, Northern Ireland (DEL), with the latest RAE assessment in 2008. RAE ratings represent the recognition that research excellence is pivotal to the financial success of this country and form part of a major initiative by the UK government to invest in science research and promote innovation. The introduction of the Research Assessment Exercise (RAE) ratings (http://www.rae.ac.uk) have also rendered science research excellence an important deliverable and a measure of success for Universities in the United Kingdom but they have also intensified the pressure for Universities to enhance research output. This has also increased the drive to engage in translational research: scientific research that can have direct benefits for society or that can be made into a product that improves health or patient care, although many researchers and clinicians feel that RAE has had deleterious effects on the quality of research conducted (Williams, 1998; Banatvala *et al.*, 2005). Collectively, these policies sparked major changes in the philosophy and culture of University life and have opened fresh debate on what Universities are expected to offer to society (Barnett, 2003). However, one concept everyone agrees on is that these government policies that directly encourage and promote scientific research may inevitably drive research and teaching apart and make the links between the two more difficult to shape.

Changes in Higher Education Culture and Policies

Universities have quickly responded to these forces by adopting a business-like ethic and expanding to meet demands placed by society and government policies (Morley, 2003). As a result, the University environment is one of constant change and one that struggles to balance traditional values of what academic institutions should stand for with new demands for target-driven performance assessments and the merits and perils of financial independence (Lomas, 2006). There have been considerations and calls at policy level to separate research and teaching activities in order to achieve high status in RAE and to enhance revenues. The rise of a number of science research centres, where staff are completely free of teaching obligations and able to concentrate on research, is a reaction to these policies. However, is isolating career researchers from University teaching environments beneficial to science research output, but is it also another way in which research and teaching are now driven further apart (McNay, 1999)? Even for departments committed to teaching, the ways teaching activities are managed do not naturally foster links and references to academic staff research. To achieve career progression, science academics are assessed mainly on the quality of research they conduct relating to RAE and on the revenue they bring in for the division/organisation. Teaching duties are therefore largely regarded by many academics as a "necessary evil," a drain in terms of time, resources, and effort, without major returns in terms of benefits for the academic. Without a doubt, academics and students are the primary recipients of the consequences of these policies.

From the Academics' Point of View: Demands on Time and Commitments

When questioned directly, most academics agree that student learning should be enhanced through scientific research and in research-rich environments, and they identify acquisition of research skills as an important aspect to student learning experiences (Zamorski, 2000; 2002). However, some studies

demonstrate that under the present changes in University policies, teaching and research are independent of each other, and a need to create circumstances where research and teaching may meet is necessary and beneficial for student learning (Hattie and Marsh, 1996; Marsh and Hattie, 2002). Others argue that those academics who view teaching as an integral part of the wider debate in their discipline and as a natural extension of their scholarship tend to make stronger connections between research and teaching in the way they instruct students to understand and experience research (Prosser et al, 2004, 2005). But how would this be a conceivable possibility, given the increasing demands on academics' time and effort?

As mentioned above, academics' career prospects are now largely dependent on the quality of their research activities as a source of funding/income for Universities. With the introduction of the RAE ratings system, it has become the main task of academic staff to conduct research that leads to strong publication output in reputable journals, leading to generation of external funding in the form of grants as well as intellectual property as an additional source of revenue. The RAE has also introduced a more business-like approach to conducting research in academic environments and has burdened academics with management, organisational and administrative responsibilities, but has also introduced a stronger political culture within the scientific community. These pressures leave little time for the University lecturer to devote to planning and implementing links between research activities in order to enhance students' deep knowledge and produce highly trained, research-led graduates. Anecdotal evidence to the pressures felt by UK academics was communicated to me at a recent discussion with three King's College London academics. For some time now, United States-based scientific journals have difficulties convincing UK-based academics to review research manuscripts submitted for publication, a sign of how overwhelmed academics are by their commitments and the pressures to achieve for the next RAE rating round. Thus, under the intense scrutiny of government-driven University and departmental targets, academics are abandoning any activities they consider less vital for their career progression. Amongst my colleagues in science and medicine academics, all consider teaching as an important aspect of their academic role and experience, but inevitably they feel forced to allocate teaching a second priority to their research as they struggle to meet increasing demands.

Research and Teaching Links: Students' Perceptions and Academic Culture

Students consider excellence in research an important factor in their decision to choose a University for undergraduate studies. Many perceive that studying in research-rich environments adds value to teaching and greatly benefits the quality of their learning (Neumann, 1994; Zamorski, 2002; Jenkins 2004; Hunter et al., 2007). However, despite student perceptions, a concrete link between research quality and student learning experience has not been established to date (Seymour et al., 2004; Trigwell, in press, quoted in Jenkins and Healey, 2007). Students see themselves as recipients of research-acquired knowledge rather than participants in University research (Zamorski, 2002; Brew, 2006). One therefore wonders how the student experiences of learning can benefit from academic research and how students can become active participants rather than recipients. This link is particularly poor in undergraduate education.

Another parameter is the introduction of University fees, arguably turning students into consumers or customers with the power to drive policy and change, which in turn may contribute to a more plastid curriculum to meet demands and needs of the changing future workforce (Sharrock, 2000; Johnston, 2004). Tuition fees also bring demands on students' time. Many now need to continue working while studying to ease the financial impact on their families and this has inevitable repercussions on the way they choose to learn and engage with their courses: students inevitably make strategic selection of what they need to learn to attain their degrees. Under these conditions, deep learning and research-based knowledge acquisition becomes a commodity. However, now more than ever, and certainly in scientific disciplines, our University students are expected to acquire research-led knowledge and develop the ability to analyse and conduct research as an integral part of their academic and professional development (Garrick and Rhodes, 2000; Scott, 2002; Zetter 2002).

Therefore, the challenge in science education is to strive to develop research-based teaching as Wieman describes (2004, pp. 8-9): "A meaningful science education involved transforming the way in which students think by promoting a progression from 'novice' to 'expert' in both their attitudes and their approaches to the discipline and problem solving in that discipline. Today's educator should aim not simply to produce more scientists, but rather to get all students to learn to think about science like a scientist. Similarly,

the goal of education in general is to get students to think like experts more broadly." In today's knowledge-driven society, these can only be truly accomplished if teachers can introduce research-led, research-oriented, research-based, and research-tutored teaching in undergraduate science curricula (Scott, 2002; Griffiths, 2004; Healey, 2005). But could this be realistically accomplished by overworked academics facing their own pressures on time, knowledge acquisition, achievements, and expectations?

Drawing Links Between Academic Research and Teaching: A Personal Perspective

My experience in University education has highlighted the great tensions and disparities in the messages of policymakers and institutions to academic staff. In response to the implementation of the RAE rating system, academic divisions regard research output as their main aim. Coate et al. (2001) report that departmental managers considered research and teaching to be synergistic in theory, but found it easier to manage these as separate activities. This separation and also the inability to foster links between teaching and research are true in my experience and has been acknowledged and debated (Elton, 2001; Henkel, 2004). Furthermore, it has been shown that staff engaged in teaching are undervalued and in some cases marginalized, compared with those concentrating on research (Lucas, 2006). In my experience, I have also found this to be the case. Despite the emphasis on research output, and in contrast to the general perceptions of teaching being inferior to research as a scholarly activity, lecturers with heavy research loads, demanding management responsibilities, and punishing schedules writing grant and research papers are obliged to undertake teaching duties as part of their roles. Asked directly, most science and medicine academics consider teaching to be a rewarding experience they wish to conduct effectively. Science and medicine teaching can be conducted in many forms, including negotiated teaching formats and in the form of apprenticeships, and is pivotal to University science education and at the heart of science and medicine academics.

Unlike many of my fellow academics, my main duties are in academic research, and thus my contribution to teaching in University is not compulsory. To this effect, I have been in the privileged position to a) select subjects that I have a keen interest in, b) choose topics of biology and immunology where I have conducted research, and c) define areas to incorporate in my teaching which I wish to explore in my own research. Therefore, I find that my research interests, experiences, and knowledge largely inform the content and style of my teaching practice. As a researcher, I implement a variety of tools to promote enquiry-based student learning, and I believe that this is an important aspect of bridging scientific research with teaching.

Despite the obvious challenges I face as a researcher, lab supervisor, and working mother, to allocate time to the limited teaching duties I have agreed to undertake, I appreciate that I, more than my colleagues, am able to dedicate reasonable time and thought to preparing my teaching duties. I am also more likely to agree to conduct teaching-related activities in and out of the laboratory environment, including meeting students for questions and help and conducting small group tutorials prior to exams and assignments. Thus, I have the flexibility and opportunity to draw links between what I do in the lab and what I teach my students both in and out of the classroom.

I also reflect on another observation drawn from my personal experience of fostering research and teaching links to enhance student learning. This stems from teaching undergraduate students in a negotiated teaching format, so they can develop research skills and research-led thinking, by undertaking lab research projects based on my own and my close colleagues' scientific research work. This experience has been much more challenging than I had originally anticipated. I think major factors here are a) the complexity of scientific disciplines, b) the requirement for specialised training in experimental skills and equipment handling, but also c) the cognitive processes required to develop experimental and research-led thinking. These issues point to the concrete need for the design of appropriate and rather simple projects with clear achievable aims that inevitably have little benefit for the teacher. Also, due consideration should be given to the impact lengthy training has on time management for the lab supervisor/teacher, making this aspect of student learning a time-consuming endeavour for the research-led teacher.

Despite my belief that research and teaching can be entwined and my resolve to promote the research-teaching nexus in my own practice, working in academic environments strongly highlights the tensions arising from the co-existence of teaching and research. I thus believe that to achieve a positive teaching-research nexus in higher education, such links should be promoted in a form that benefits all stakeholders, including academic staff.

What Can Be Done to Make Things Easier?

Despite academics' best intentions, many feel that few opportunities to link their research and their teaching exist, and indeed there is an ongoing debate whether these activities have become uncorrelated in modern academic life (Marsh and Hattie, 2002).

However, since science research-based learning forms an integral part of student learning, the notion of separating research and teaching in scientific disciplines contradicts our aim to train the next generation of highly skilled scientists. Indeed, most science researchers are incredibly committed to improve teaching and would welcome opportunities to better integrate the two disciplines. Thus, the foundations as well as the enthusiasm and willingness are in place to make the research-teaching nexus a reality. Here, I suggest some key changes in departmental, institutional, and/or government policies (Jenkins & Zetter, 2003), which can potentially increase the opportunities where academics can implement these links. The outcomes may be beneficial for both teacher and student experiences and will go a long way to redefine the roles Universities play in society in educating the new generation of science professionals.

Suggestion 1: Aligning Staff Research Interests with Teaching Activities

The least painful policy change would be implementation of changes in teaching management at departmental, divisional, or institutional level, depending on the size of the organisation. Changes would comprise allocation of teaching duty according to staff area of research interest and would require simple good management skills. Minimal investment in resources would be necessary to achieve this. Prior to organisation of the curriculum, consultation with academic staff would assist managers or course organisers to allocate teaching duties according to individual research and teaching interests. As an example, I use here my interest in Cancer Immunity and Immunotherapy, a rapidly expanding area of science research in which I have been involved for a number of years. I would welcome to teach a topic in this field at any level. This would have benefits for my students' learning experiences as well as for my own professional development as a researcher: a) it would serve as a further incentive to constantly update my knowledge on current developments; b) my teaching would be informed directly from my laboratory research; c) drawing from my own research experiences, I can implement research-led, research-oriented and research-tutored learning; and d) the experience would help direct my research strategies (Elliot, 1991). Despite my enquiries, at present I am not aware of a manager or organiser to whom I would address enquiries. I believe students would benefit from academics' specialist research knowledge, experience, interest, and passion for their chosen area of research, and that this could be facilitated by a more formalised recognition of the "research-teaching nexus" within the curriculum.

Suggestion 2: Teaching Assessment Exercise Ratings

The second policy change I suggest is implementation and enforcement of Teaching Assessment Exercise ratings at national and institutional levels. This should be used as an incentive and a tool to motivate academics to excel in their teaching, but also importantly, to reward and celebrate quality of teaching as a vital contribution to academic experience and life and one that benefits students, academics, Universities, and society. Academics would be more willing and certainly motivated to link their research interests and activities to their teaching, knowing that this effort would be rewarded and would benefit their academic career progression. Despite the obvious benefits in driving teaching excellence and in placing teaching together with research at the centre stage of University education, potential disadvantages could be envisaged. There exists the danger that a teaching ratings system, by rendering teaching a target-driven endeavour, may serve to render University teaching more prescriptive, discouraging academics from implementing new teaching strategies and tools, and thus become less reflective in their teaching methods and style.

A desire to reward outstanding teaching exists and has led to the implementation of a number of incentives for individual academics and Universities that are aimed to reward teaching excellence. Policy makers in Australia have recognised the importance of strengthening the research-teaching nexus as an imperative for the future of University education. This has resulted in a long-standing tradition of rewarding excellence and innovation in University teaching through initiatives such as the Learning and Teaching Performance Fund and the Australian Awards for University Teaching (AAUT) (Carrick Institute, 2005; Nelson, 2002, 2003). These awards bring not only prestige, but also direct and indirect funding for the recipient academic staff and affiliated University, although there is an on-going debate whether these policies have served to enhance research teaching links in Australian Universities (Halse et al, 2007). In the United Kingdom, on a national scale, the Higher Education Academy's National Teaching Fellowship Scheme, is a programme designed to enhance awareness of the importance of teaching quality both at academic and national levels, please see: (http://www.heacademy.ac.uk/ourwork/professional/ntfs). Individual Universities have also launched similar schemes. King's College London has set up the Awards for Excellence in Teaching, funded by the Higher Education Funding Council for England (HEFCE), which calls on undergraduate and postgraduate students to nominate a member of teaching staff for an annual

award; please see: (http://www.kcl.ac.uk/about/structure/admin/acareg/qaaa/teaching.html). One of the criteria for nomination is that the candidate academic is active in research, as research-led teaching is named as one of the strategic goals of King's College London, and therefore the College looks for opportunities to encourage and reward a positive nexus between teaching and research. In the 2006/07 Academic Year, there were 15 award recipients at King's College London. Such policies, together with a nationally implemented Teaching Assessment Exercise ratings system for academic departments and Universities, may gradually bridge the present divide between research-based academics and teaching academics. Finally, these strategies may help to reinstate the importance of teaching as a fundamental activity integral to higher education.

Suggestion 3: Flexible Allocation of Research and Teaching Responsibilities

The separation of teaching only and research only staff is generally regarded as another policy that pulls apart research and teaching activities. A more flexible approach to the allocation of teaching and research responsibilities would entail agreement of percentages of time that each academic spends on each activity for an arranged time interval. This system is already in effect in some European Universities (e.g., Belgium, the Netherlands, Scandinavia). Practically speaking, from implementing this policy, two key features have emerged. One is the emphasis on individuality of academic job descriptions resulting in a unique evaluation system that measures academic excellence as a function of a combination of achievements in research, teaching, public dissemination of knowledge and innovations, as well as links with industry and professional practice. The other is the potential to highlight the interests and aptitudes of individual staff and academic groups (de Weert, 2004). The Dutch educational system has pioneered this approach, and the practical application of this instructs that such processes require fostering but also adaptation to suit different academic disciplines (de Weert, 2001). From the European University experience to date, it seems clear that in order to promote the research-teaching nexus, individual academic staff competencies and performance in each area should also be reflected in the appraisal and career advancement process, which should award equal importance to achievements in teaching and research within an organisation.

Suggestion 4: Freedom to Shape Academic Curricula

Another suggestion addresses the core difficulties faced by academics in bringing their research interests into their teaching. Researchers who are familiar with the most up-to-date developments in their discipline should be allowed to suggest and shape University curricula: a process should be implemented by which all staff have an input on what are the best topics to include in undergraduate and postgraduate subjects. This is already happening to an extent at a departmental level, but to be truly effective, it should be University policy to identify the links between research and the teaching activities provided to students. Such a centralised policy should truly reflect the quality and diversity of research within an organisation and translate it to student teaching and learning. This would be another way students stand to benefit from a research-rich academic environment.

Suggestion 5: Allocation of Teaching Duties to Junior Research Staff

This suggestion comes from a tested model used in US Universities for a number of years. This involves junior members of staff, such as PhD students and postdoctoral researchers, taking over some teaching duties as part of their work contracts. Such a policy would have a number of benefits. Sharing teaching responsibilities with junior staff would free lecturers' time from the more basic subjects and provide valuable knowledge and teaching experience for aspiring young academics. It would also provide an opportunity for the young teachers to interact with students and use this interaction to link their teaching to their research experiences, use their teaching experiences to inform their own research and help appreciate the research-teaching nexus early in their careers. As Elsen et al. (2007) propose, the policies should aim to deliver "research intensive education" and this aspiration is highly relevant in scientific disciplines. Furthermore, this policy can also encourage and nurture a nexus-favourable culture in higher education. Universities in the United States already benefit from fostering a favourable science research and teaching environment, where academics consider linking teaching and research as part of their wider role and contribution to University life and society.

Suggestion 6: Influence of National Benchmarking Guidelines on Undergraduate Curricula and Research-based Teaching

Universities follow national guidelines for setting undergraduate and graduate benchmarks and programme specifications. These guidelines help shape academic curricula in the UK. The Quality Assurance Agency for Higher Education, established in 1997, is an independent body subsidized by UK higher education funding organisations, Universities, and colleges that

works to define and safeguard academic standards (http://www.qaa.ac.uk). The role of QAA involves exercising constant quality assurance, but also promoting continuous improvements in the management and quality of higher education. The benchmarking guidelines set by the QAA are followed by UK Universities. Is it then reasonable to envisage that these have the potential to shape and influence the nexus between research and teaching?

According to the QAA guidelines, Biomolecular Science and Bioscience degree graduates should have attained a range of skills by graduation. These include intellectual, research and biomedical laboratory practice skills, together with other "soft" skills including communication, information technology, numeracy and data analysis, and interpersonal and teamwork attributes. The graduates should also be aware of moral and ethical issues raised within their discipline, consider views that differ to their own, and be capable of critically assessing and engaging in intellectual argument. The graduates should also be familiar with health and safety policies, good laboratory practice, risk and COSHH assessments, and the importance of quality control and quality assurance (http://www.qaa.ac.uk/academicinfrastructure/benchmark/honours/biosciences.asp). All these skills can be best learned and cultivated in a research-led teaching environment.

The QAA guidelines normally translate into a range of Programme Specifications set by individual Universities, and as such they can influence and shape undergraduate science curricula. My experience of undergraduate curricula in the UK suggests not only a strong link with the QAA benchmarking, but also a strong indication that, nationally and regionally, we aim to produce research-thinking professionals out of undergraduate science education. University science programme specifications incorporate training undergraduates to attain a range of skills and knowledge that will then help them progress in different employment environments, including postgraduate research study, laboratory-based and office-based employment in biotechnology and pharmaceutical industries, scientific writing, and entry to dentistry and medicine. As science subjects are strongly research-driven, attainment of research-led thinking is crucial for the whole range of professional development avenues. Therefore, linking research and teaching will benefit all students regardless of their career aspirations.

It is indisputable that research-based teaching is crucial in post-graduate science education. But from the QAA guidelines and undergraduate Programme Specifications, it is now becoming clear that, because of the nature and level of our graduate skill base required, research-led thinking should now be integral to the undergraduate learning experience. This applies whether a graduate decides to pursue a career in research or in a science-related discipline or environment. Superior graduate skills in science can be best cultivated in research-led, research-rich learning environments; it therefore follows that undergraduate curricula should reflect national guidelines to consider the "nexus" an important tool in the training of the ultimate deliverable: producing the next generation of research-thinking professionals at all levels. I therefore submit that national benchmarking guidelines should be a medium used nationally to directly promote and encourage research-led teaching and thus may have a direct and positive influence on the "nexus" and consequently on the quality of science professionals. Should national benchmarking guidelines further emphasize the importance of research-led teaching? It certainly has the potential to enhance science education and redirect thinking in academic research and teaching culture.

Conclusions

To "think like a scientist" forms such an integral part of science student learning, it is almost inconceivable that science research and teaching may not be entwined in University education. To succeed in their promise to provide good quality higher education to the next generation, government, and Universities should work together to address disparities and fill gaps in research-teaching nexus. The evidence points to an urgent need to confront issues in a way that will benefit students, academics, Universities, and society. Policymakers in the United Kingdom may learn from the experiences of European, Australian, and North American Universities and locally implemented policies and initiatives designed to promote science research and teaching links. Drawing from the results of these, it seems that linking our science research and teaching may be a crucial aspect of our contribution to society as academics and scientists; however, the relationship between the two is clearly vastly complex and there is no simple solution. One could therefore suggest that rather than rely on an individual strategy to encourage this complex relationship between teaching and research in science education, the key to enhancing the research and teaching nexus may lie in the simultaneous implementation of complementary policies that may have synergistic effects.

In this paper, I have put forward a non-exhaustive list of proposals to reverse the current trends that pull research and teaching apart in the United Kingdom. I believe that policies and guidelines should be applied, possibly on a national basis, or by individual Universities in accordance with institutional missions and culture. Such policies and set guidelines should reflect the educational philosophy and cultural outlook

of each institution. One way of evaluating some of these strategies would be to implement a number of pilot projects that evaluate the potential success of each suggestion over a defined period of time. The outcomes of such an exploratory journey would provide worthy insights and instruct on efficacy and suitability for implementation on a larger, possibly national, scale. In many disciplines, but certainly in science, a positive "nexus" between teaching and research may not be intuitive in today's market-driven climate, but it could be cultivated and can have enormous benefits for us all.

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Priorities and Understanding of Faculty Members Regarding College Students with Disabilities

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As a result of legal protections and the effects of inclusive reforms (e.g., improved academic skills, heightened expectations), more students with disabilities are entering higher education than ever before. The priorities and understanding of university faculty members directly shape the educational experiences and success of the rapidly growing group of college students with disabilities. Previous research in this area has focused primarily on faculty members' knowledge of legal issues, general attitudes toward students with disabilities attending college, and willingness to make accommodations. This study expands the extant knowledge base by examining the priorities and understanding of 307 faculty members at an 8-campus university system regarding university students with disabilities in the following areas: *Legal*, *Accommodations-Willingness*, *Accommodations-Policy*, *Universal Design for Instruction*, *Disability Characteristics*, and *Disability Etiquette*. Participants' ratings indicated that (a) accommodation policies and disability etiquette were viewed as highly important and were being addressed satisfactorily; (b) issues related to law, Universal Design for Instruction, and disability characteristics were important but were not being addressed satisfactorily; and (c) issues related to willingness to provide accommodations were neither highly important nor being addressed satisfactorily. Implications for faculty training are discussed.

More students with documented disabilities are entering higher education than ever before. The proportion of college freshmen with disabilities more than tripled from 1978 to 1998, rising from less than 3% to approximately 9% (HEATH Resource Center, 1999). It should be noted that this number almost certainly underestimates the prevalence of students with disabilities in higher education, because many students do not choose to self-identify their disabilities. Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act (ADA) of 1990 mandated the rights of students with disabilities to attend institutions of higher education. Once students with disabilities enroll in higher education, a successful college experience is associated with far-reaching social and economic benefits. For example, a college graduate with a disability is three to five times more likely to be employed than a person with a disability who never attended college (United States Department of Labor, Employment, and Training Administration, 2004). As such, access to colleges and universities is not only a legal and moral imperative, but it also represents a significant opportunity for people with disabilities to improve their lives.

Fortunately, many people with disabilities are not only attending postsecondary institutions, but are increasingly succeeding in them. As a whole, their academic performance, retention rates, and graduation rates more closely resemble those of their non-disabled peers than ever before (Stodden, Whelley, Chang, & Harding, 2000). Although significant advancement has been made in providing access for and including students with disabilities in higher education settings, these students still comprise a subgroup that faces an array of institutional and personal barriers. Despite marked enrollment increases, people with disabilities attend postsecondary education at a lower rate than the non-disabled population (Wehman, 2005). Furthermore, they drop out of higher education at a higher rate than students without disabilities (Murray, Goldstein, Nourse, & Edgar, 2000) and those who do graduate take longer to complete their degree programs than students without disabilities (Brinckerhoff, Shaw, & McGuire, 1992). One factor that could help to explain the struggle that many students with disabilities face in higher education is the relationship and related interactions that they have with university faculty. Students with disabilities have indicated that faculty and administrators do not understand the issues they face in pursuing a college education (Cook, Gerber, & Murphy, 2000). For example, Rumrill, Koch, Murphy, and Jannarone (2002) reported that college graduates with disabilities rated their former faculty advisors as having low to moderate knowledge regarding issues related to their disabilities.

The success of any college student, particularly in the academic realm, is to some degree determined by the type and quality of interactions that he or she has with his or her instructors. As those who provide academic instruction and help to determine campus climate, the priorities and behaviors of college faculty are important determinants of the quality of higher education experiences for students with disabilities. A number of priorities and behaviors of college faculty members may impact the post-secondary success of students with disabilities, including knowledge of

relevant law, willingness to provide accommodations, use of effective instructional practices, knowledge of disability characteristics, and use of appropriate disability etiquette.

Legal Knowledge

The Rehabilitation Act of 1973 and the Americans with Disabilities Act (ADA) prohibit postsecondary institutions from subjecting students with disabilities to discriminatory acts. However, postsecondary institutions report difficulty in providing college students with disabilities accommodations that meet the requirements of federal law (Brickerhoff et al., 1992; Burns, Armistead, & Keys, 1990; Heyward, Lawton, & Associates, 1995), which might stem from faculty members not knowing the law. Thompson, Bethea, and Turner (1997) reported that less than 18% of faculty members surveyed indicated that they were familiar with Section 504 of the Rehabilitation Act, and only 50% said that they were familiar with the ADA (see also Dona & Edmister, 2001). Most faculty members did not realize that they need only provide accommodations when requested, and they had little understanding of what made a reasonable accommodation "reasonable," as stated in the law. Additionally, the majority of faculty members were unaware that students with disabilities did not have to disclose diagnostic information to them in order to receive accommodations. However, Benham (1997) surveyed 200 faculty members randomly selected from three universities and found that they had "a basic knowledge" (p. 124) of the ADA. These studies often used legal terminology in their surveys, and it is possible that faculty members' understanding of the spirit or intent of the laws was not accurately assessed because of the phrasing of survey items. Further research appears needed to further investigate faculty members' understanding of the spirit of relevant laws in contemporary post-secondary institutions.

Accommodations

Because traditional modes of instruction (e.g., lecture) and testing (e.g., timed essays and multiple choice exams) in postsecondary institutions do not accord with the learning characteristics and needs of many students with disabilities, faculty members are required to make reasonable accommodations for students with disabilities. Overall, faculty members have expressed a willingness to provide various teaching accommodations in their classrooms (e.g., Bourke, Strehorn, & Silver, 2000; Leyser, Vogel, Wyland, & Brulle, 1998; Matthews, Anderson, & Skolnick, 1987). However, it appears that many faculty members may misunderstand fundamental issues regarding reasonable accommodations. For example, Cook, Hennessey, Cook, and Rumrill (in press) reported university faculty often perceived accommodations as providing an unfair advantage to students with disabilities.

Despite their generally positive attitudes, faculty have been less willing to provide certain accommodations such as allowing exclusive extra credit, overlooking misspellings or incorrect grammar, permitting course substitutions, and allowing students to turn in tape recorded assignments (e.g., Matthews et al., 1987; Satcher, 1992). It appears that faculty are willing to provide accommodations for students with disabilities only to the extent that they do not lower the academic standards of their courses or entail too much effort on the part of the faculty member (e.g., Matthews et al.; Satcher; Sweener, Kundert, May, & Quinn, 2002). It appears, then, that there are two issues that merit further investigation: (a) faculty members' understanding of policies related to providing reasonable accommodations and (b) more definitive determination of which accommodations faculty members are, and are not, willing to provide.

Universal Design for Instruction

Universal Design for Instruction (UDI) is an approach to teaching that is characterized by the proactive design and use of inclusive instructional strategies that benefit a wide range of learners and minimize the need for individual accommodations (Scott, McGuire, & Foley, 2003). The nine guiding principles of UDI are equitable use, flexibility in use, simple and intuitive use, perceptible information, tolerance for error, low physical effort, size and space for approach, community of learners, and instructional climate (Scott, McGuire, & Shaw, 2001). For example, course material is provided in an electronic format so that students can access it using text to speech software or Braille readers. College students with disabilities have reported that they enjoy and benefit from their instructors implementing UDI principles (McGuire & Scott, 2006). However, we could not identify any studies examining the degree to which faculty members were incorporating UDI in their instruction or whether they believe it is important to do so.

Understanding Disability Characteristics

Having a basic understanding of specific disabilities and the characteristics of those disabling conditions may alleviate the insecurity that some faculty feel when teaching and interacting with students with disabilities. Without a basic understanding of a student's disability, faculty members may believe that students with disabilities are trying to take advantage of

or cheat the system (Williams & Ceci, 1999). Benham (1997) reported that faculty had "at least a basic knowledge … of characteristics of specific disabilities" (p. 129). Akasmit, Morris, and Leuenberger, (1987) found that university faculty members had a limited amount of knowledge about the nature and needs of students with disabilities. In addition to these surveys being dated, neither article reported descriptive statistics regarding their findings that faculty members had a limited amount of knowledge of disability characteristics. Further research seems warranted to more adequately describe the knowledge of contemporary university faculty members regarding specific disabilities.

Disability Etiquette

Students with disabilities should be able to feel comfortable in university classrooms, without having others stereotype them and without worrying that their confidentiality will be breached. Because faculty fulfill leadership roles that shape classroom and campus climate, it seems particularly important that faculty members not hold stereotypes about students with disabilities (e.g., that students with certain disabilities are all courageous or all lazy), use respectful language (i.e., person-first language), and protect students' confidentiality. Despite the importance of this issue, a search of the literature revealed no studies examining faculty members' beliefs in or use of appropriate disability etiquette.

Importance and Prevalence of Faculty Members' Beliefs and Behaviors

Schumm and Vaughn (1991) identified a gap between the beliefs, skills, and practices of K-12 teachers when it comes to working with students with disabilities. That is, teachers reported very positive attitudes towards the inclusion of students with disabilities and indicated having some skill in making accommodations for these students; however, they reported that they did not actually make accommodations for these students at the same levels as their beliefs and skills. As such, it appears that meaningful differences may exist between educators' beliefs and their actual practices. Accordingly, in relation to educating college students with disabilities, it is important to examine not only the degree to which faculty members believe that the issues reviewed above are important, but also the degree to which the issues are being addressed on their campus.

Research Questions

The study is guided by two primary research questions concerning the priorities and practices of university faculty regarding college students with disabilities.

1. What high-importance issues do faculty members feel are being addressed satisfactorily? (i.e., what are the strengths?)
2. What high-importance issues do faculty members feel are not being addressed satisfactorily? (i.e., what are the weaknesses?)

Method

We used survey methodology to examine which issues regarding college students with disabilities faculty perceived as most important and which issues they saw being adequately addressed at their institution.

Participants

We invited all 2,168 faculty and instructors at a large 8-campus university system in the Midwestern United States to participate in the study. The demographic characteristics of the 307 respondents (14% return rate) are described in Table 1. The Human Resources Department at the university, which e-mailed invitations to participate in the survey to all faculty members (n = 2,168) at the 8-campus system, provided data on the ethnicity, gender, and academic rank of faculty members to whom they sent invitations to participate. The ethnicity of respondents was remarkably similar to that of the target population. Whereas 89% of the target population was white (non-Hispanic), 87% of survey respondents were white. Four percent of all faculty members at the 8-campus system were African American compared to 3% of survey respondents. Females were over-represented among survey participants. Whereas 50% of the target population was female, 66% of survey participants were women. Regarding academic rank, instructors, adjuncts, and lecturers were under-represented among survey respondents. Whereas individuals with these ranks comprise 52% of university faculty, they represented 34% of survey respondents. Assistant, associate, and full professors comprised 24%, 14%, and 10% respectively of the faculty within the eight campuses and 34%, 22%, and 10% respectively of survey participants.

Table 1
Participant Demographic Information

Variable	*n*	%
Gender		
Female	157	66
Male	80	34
Race/Ethnicity		
White	212	87
Hispanic	5	2
Asian/Pacific Islander	10	4
African American	7	3
Other	9	4
College		
Architecture	2	1
Arts and Sciences	106	45
Business	11	5
Communication and Information	19	8
Education	34	14
Fine and Professional Arts	43	18
Nursing	12	5
Technology	10	4
Other	1	0
Rank		
Instructor/Lecturer	84	34
Assistant Professor	82	34
Associate Professor	53	22
Full Professor	24	10
Status		
Non-tenure Track	103	43
Tenure Track (non- tenured)	58	24
Tenured	80	33

Note. Percentages are based on total number of faculty members who responded to each demographic item.

Survey Instrument

Existing literature was used to generate a potential pool of questions. The six broad areas covered in the survey—legal issues, UDI, characteristics of specific disabilities, accommodations-willingness, accommodations -policy, and disability etiquette—reflect issues related to postsecondary faculty members teaching students with disabilities that (a) appear to influence the experiences and outcomes of postsecondary students with disabilities and (b) have not been researched or are in need of further research, as indicated by the review of literature.

Specific issues that were discussed in previous literature as influencing or potentially influencing the outcomes and/or experiences of postsecondary students with disabilities (either empirically, theoretically, or conceptually) were used as the basis for generating specific items in each of the broad areas. Items were written in a format to facilitate survey completion (Dillman, 2000). According to Dillman, questions and answer categories that are vague have a greater potential for measurement error. Accordingly, items were clear (e.g., avoided confusing legal terminology), positively phrased statements of faculty members' understanding and willingness to perform specific behaviors, and response options were also succinct and clear (e.g., strongly disagree, disagree, agree, and strongly agree).

The survey is constructed with 38 statements followed by two rating scales regarding respondents' perceived importance and agreement with the statements. Faculty rate the degree to which they feel that each statement reflects an idea or behavior that they personally feel is important on a four point Likert-type scale (where 1 = very unimportant, 2 = unimportant, 3 = important, and 4 = very important). Then respondents rate the degree to which they agree the statement represents the general climate or practices at their university, again using a 4 point Likert-type scale (where 1 = strongly disagree, 2 = disagree, 3 = agree, and 4 = strongly agree). This dual questioning allows identification of the high importance issues for faculty as well as identification of which high important issues are and are not currently being addressed at their institution.

To enhance content validity, the first stage of pretesting involved two professors who are knowledgeable about and experienced with the education of students with disabilities in higher

education settings reviewing the survey and giving feedback (Sallant & Dillman, 1996; Dillman, 2000). In the second stage of pretesting, a small group of colleagues was given the survey exactly as it would be administered, in this case via the internet. The respondents were asked to evaluate the cognitive and motivational qualities of the survey (Dillman, 2000). The third and final stage of pretesting involved a graduate student in education, who was unfamiliar with the survey, editing the instrument for errors and potentially confusing statements that may have been missed by those too close to the content (Dillman).

The survey, *Faculty Priorities and Understanding Regarding College Students with Disabilities Scale*, ultimately contained 38 statements followed by two rating scales regarding respondents' perceived importance and agreement with the statements. Faculty were asked to rate on a four point Likert-type scale the degree to which they felt that each statement reflects an idea or behavior that they personally felt is important (where 1 = very unimportant, 2 = unimportant, 3 = important, and 4 = very important) and to also rate the degree to which they agreed the statement represents the general climate or practices at their university, again using a 4 point Likert-type scale (where 1 = strongly disagree, 2 = disagree, 3 = agree, and 4 = strongly agree). This dual questioning allowed identification of the high importance issues for faculty as well as identification of which high important issues are and are not currently being addressed at their institution.

Procedure

Following the procedures of the Tailored Design Method adapted for e-mail (rather than mail) (Dillman, 2000), there were three points of contact between the researcher and the respondents. The first contact was the initial e-mail soliciting respondents to follow the link to the online questionnaire and participate by completing the survey. One week after the initial e-mail there was a follow-up e-mail that thanked participants who did respond and asked those who had not responded to please follow the link and complete the survey. Two weeks after the initial e-mail there was a final e-mail, again thanking those who had responded and telling those who had not responded that the survey would close in one week and that their responses were very important. Each e-mail included a link to the survey that was posted at the Zoomerang website. To enhance return rate, all correspondence with the respondents conveyed the relatively low cost for participating, the ease of completing the online survey, protection of their confidentiality, and the social usefulness and importance of their responses in building a research agenda in this very important area (Dillman, 2000).

Analysis

This exploratory study used descriptive statistics to examine what issues faculty members consider important and agree are being addressed at their institution. The proportion of participants who rated the importance of an item as "important" (rating of 3) or "very important" (rating of 4) constituted the importance score for each item. Similarly, the proportion of participants who rated their agreement with an item as a 3 (agree) or 4 (strongly agree) constituted the agreement score for each item. We established cutoff points of 75% to separate high importance and high agreement items from and low importance and low agreement items. We selected these cutoff points because they represent the point at which the clear majority of respondents felt an item was important or agreed that the issue was being addressed at their campus.

Results

Internal Reliability of Survey

Internal reliability was estimated by calculating Cronbach alphas separately for importance and agreement ratings for each of the six themes, as well as for the entire scale. Results indicate that Cronbach alpha coefficients ranged from .76 to .97 for importance ratings of the six themes (.95 total scale importance rating), and from .72 to .94 for agreement ratings on the six themes (.96 for total scale agreement ratings). See Table 2 for Cronbach alpha coefficients for all themes.

High-importance and High-agreement Items

Thirty four items (89% of all items) were categorized as "high-importance" items, indicating that at least 75% of respondents rated the item as important or very important. Of those items, a total of 16 items (42.1% of total scale) were rated as both high-importance and high-agreement. See Table 3 for a listing of high-importance and high-agreement items. The items that received both high-importance and high-agreement ratings represent issues that the majority of faculty members feels are important and are being addressed or implemented satisfactorily at their university. Seven of the 10 items were under the theme of *Accommodations-Policy*, four of the five items under the theme *Disability Etiquette*, two of the five items under the theme *Accommodations-Willingness*, two of the seven items under the theme *UDI*, and one of the four items under the theme *Legal* were high-importance and high-agreement items. *Disability Characteristics* is the only theme for which

Table 2
Estimates of Internal Reliability for Survey Themes

Theme	Number of items	Cronbach alpha	
		Importance	Agreement
Legal	4	.77	.72
Accommodations-Policy	10	.89	.90
Accommodations-Willingness	5	.79	.79
Disability Etiquette	5	.76	.77
Disability Characteristics	7	.97	.94
Universal Design for Instruction	7	.82	.87

no item was rated as both high-importance and high-agreement.

High-importance and Low-agreement Items

The items that received a high-importance rating and a low-agreement rating represent those items that the majority of faculty members feel are important but are not being addressed or implemented satisfactorily at their university. There were a total of 18 items (47% of total scale) that were rated as high-importance but low-agreement. All seven items under the theme *Disability Characteristics*, five of the seven items under the theme *UDI*, three of the four items under *Legal*, two of the 10 items under *Accommodations-Policy*, and one of the five items under the theme *Disability Etiquette* were high-importance and low-agreement items. *Accommodations-Willingness* was the only theme with no high-importance and low-agreement items. Table 4 lists the high-importance and low-agreement ratings.

Low-importance and Low-agreement Items

Respondents rated only four survey items, one of the ten items in *Accommodations-Policy* (10%) and three of the five items in *Accommodations-Willingness*, as both low-importance and low-agreement (see Table 5).

Discussion

We investigated beliefs of faculty members at an 8-campus university system about the importance of specific issues related to college students with disabilities and the extent to which they agreed that the issues were being addressed at their campuses using a researcher-developed, online survey.

Faculty Members' Priorities and Understanding

We grouped the items into three separate categories: high-importance and high-agreement ("high/high"), high-importance and low-agreement ("high/low"), and low-importance and low-agreement ("low/low"). The high/high items can be thought of as "success stories," in that a decided majority ($\geq$ 75%) of faculty members felt that these are important issues that are being satisfactorily addressed at their institutions. The high/low items can be viewed as important weaknesses that most faculty members feel are important, but many feel are not being addressed satisfactorily. High/low items seem to be prime areas to target for change, as faculty members feel they are high priority concerns in need of improvement. Alternatively, efforts to bring about change related to low/low items may be particularly difficult. Although faculty members do not feel that these issues are being addressed, they do not feel that the items are highly important and, therefore, may not believe that they need to be addressed.

High importance and high agreement themes. The theme with the greatest proportion of high/high items was *Disability Etiquette* (four of five items). It is possible that the predominantly positive attitudes faculty members have reported towards students with disabilities attending college (e.g., Akasmit et al., 1987; Rao, 2004) have lead to university instructors valuing and engaging in respectful interactions with students with disabilities. The high importance and agreement that faculty members expressed toward Di*sability Etiquette* could also be due to political correctness. That is, ratings in this area may have been influenced by what faculty members believed was desirable or expected. The only item in the *Disability Etiquette* theme that was not rated high/high was related to the use of person-first language. Agreement on this item was very low (41% agreement index) and it barely met the criteria for being a high importance item (importance index of 76%). These relatively low ratings may be a reflection of person-first language is seldom used or considered outside of disability-related fields.

High/high items comprised the majority of one other theme, *Accommodations-Policy* (seven of ten items). It appears that faculty members felt that understanding what reasonable accommodations are, that they are required, that they don't change the

Table 3
High-importance[a] and High-agreement[b] Items

Item	Theme	Importance Index	Agreement Index
2. Faculty members understand that students with disabilities must have physical access to buildings on campus.	Legal	97%	90%
5. Faculty members understand that students must self-disclose their disabling condition to Student Disability Services before they receive accommodations.	Accomm.-Policy	94%	81%
6. Faculty members understand that they are required to provide reasonable accommodations for students with documented disabilities.	Accomm.-Policy	98%	92%
7. Faculty members understand that reasonable accommodations are determined on a case by case basis.	Accomm.-Policy	97%	81%
8. Faculty members understand that reasonable accommodations do not alter their course content or objectives.	Accomm.-Policy	95%	78%
10. Faculty members understand that reasonable accommodations do not require them to lower their academic standards.	Accomm.-Policy	97%	75%
11. Faculty members understand that reasonable accommodations enable students with disabilities to have the same opportunities as their non-disabled peers.	Accomm.-Policy	96%	78%
13. Faculty members at KSU understand why accommodations for students with disabilities are necessary.	Accomm.-Policy	97%	82%
14. Faculty members are willing to make accommodations for students with disabilities regarding note-taking (e.g., providing note takers, providing copies of notes, tape record lectures).	Accomm.-Willingness	97%	85%
15. Faculty members are willing to make accommodations for students with disabilities regarding test taking (e.g., providing extended time on tests, alternate venues for tests, rephrasing of questions by proctor, alternate formats for tests).	Accomm.-Willingness	98%	84%
29. Faculty members have high expectations of success for all students	UDI	97%	80%
21. Faculty members understand that students with disabilities are individuals just like all other students and do not share common personality traits as a function of disability.	Disability-Etiquette	97%	84%
23. Faculty members do not hold overgeneralized stereotypes about students with disabilities (e.g., disability is a constantly frustrating tragedy, all students with disabilities are brave and courageous, all students with learning disabilities are lazy).	Disability-Etiquette	95%	75%
24. Faculty members are careful to protect the confidentiality of students with disabilities.	Disability-Etiquette	99%	85%
25. Faculty members include a statement about the rights of students with disabilities on all course syllabi.	Disability-Etiquette	97%	94%

Note. [a] Importance Index $\geq$ 75%, [b] Agreement Index $\geq$ 75%.

academic content of one's course, and that they give students with disabilities the same opportunities as their non-disabled peers is (a) important and (b) reflective of the general philosophy of their colleagues. Participants' positive responses are consistent with previous findings that faculty members favor the general idea of providing accommodations for college students with disabilities (Bourke et al., 2000; Matthews et al., 1987).

Only 73% of respondents agreed with the *Accommodations-Policy* item, "Faculty members at my institution understand that reasonable accommodations do not give students with disabilities an unfair advantage"—making it a high/low item. The

relatively lower agreement on this item corresponds with previous findings that some faculty members view accommodations as providing an unfair advantage to college students with disabilities (e.g., Cook et al., 2006). Faculty members agreed with the other high/low item in the *Accommodations-Policy* theme, "Faculty members at my institution know what to do when a student is unhappy with the accommodations provided to him or her," at a much lower rate (38% agreement index). This is the only item in the theme that asks if faculty members know what to do in a particular situation, rather than if they understand a concept, which may have influenced agreement ratings. Faculty members rated one item under *Accommodations-Policy*

Table 4
High-importance[a] and Low-agreement[b] Items

Item	Theme	Importance Index	Agreement Index
1. Faculty members understand the educational access provisions of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990.	Legal	95%	66%
3. Faculty members understand the process that students undergo to document their disabilities.	Legal	87%	50%
4. Faculty members understand that students with disabilities are not required to disclose diagnostic and treatment information to course instructors.	Legal	94%	65%
9. Faculty members understand that reasonable accommodations do not give students with disabilities an unfair advantage.	Accomm.-Policy	96%	73%
12. Faculty members know what to do when a student is unhappy with the accommodations provided to him or her.	Accomm.-Policy	91%	38%
19. Faculty members are familiar with assistive technology that can facilitate learning.	UDI	93%	32%
26. Faculty members provide lecture and course material in a wide variety of formats and media.	UDI	82%	46%
27. Faculty members present course content that can be understood by students with diverse learning styles and abilities.	UDI	89%	58%
28. Faculty members present course content in a well-organized, sequential manner that is paced to account for variations in students' learning styles and abilities.	UDI	90%	64%
31. Faculty members design courses that promote interaction and communication among students and between students and instructors	UDI	91%	66%
22. Faculty members use person first language (e.g., "person with a disability" rather than "disabled person") when speaking about a person with a disability.	Disability-Etiquette	76%	41%
32. Faculty members know the characteristics and learning needs of students with learning disabilities.	Disability Characteristics	91%	33%
34. Faculty members know the characteristics and learning needs of students with Attention Deficit/Hyperactivity Disorder (ADHD).	Disability Characteristics	87%	29%
35. Faculty members know the characteristics and learning needs of students with psychiatric disabilities.	Disability Characteristics	88%	24%
36. Faculty members know the characteristics and learning needs of students who have hearing impairments or who are deaf.	Disability Characteristics	93%	49%
37. Faculty members know the characteristics and learning needs of students who have visual impairments or who are blind.	Disability Characteristics	93%	47%
38. Faculty members know the characteristics and learning needs of students with chronic illness.	Disability Characteristics	89%	32%

Note. [a] Importance Index $\geq$ 75%, [b] Agreement Index $\leq$ 75%.

Table 5
Low-importance[a] and Low-agreement[b] Items

Item	Theme	Importance Index	Agreement Index
20. Faculty members' academic freedom permits them to decide how they will provide accommodations for students with disabilities in their courses.	Accomm-Policy	71%	42%
16. Faculty members are willing to allow students with disabilities to complete alternate or extra credit assignments.	Accomm-Willingness	67%	41%
17. Faculty members are willing to make accommodations for students with disabilities regarding grading assignments, tests, and papers (e.g., giving partial credit for process even when the final answer is wrong, not grading misspellings, incorrect grammar and punctuation, allowing a proofreader to review work before submission, allowing the use of calculators or dictionaries).	Accomm-Willingness	70%	41%
18. Faculty members are willing to allow course substitutions or waivers for students with disabilities	Accomm-Willingness	59%	35%

Note. [a] Importance Index $\leq$ 75%, [b] Agreement Index $\leq$ 75%.

as low/low: "Faculty members' academic freedom permits them to decide how they will provide accommodations for students with disabilities in their courses." It is possible that many faculty members believed erroneously that they are required to implement the accommodations as stated on the student's accommodation letter and assumed that their academic freedom is not a consideration in the process of determining what is a reasonable accommodation.

High importance and low agreement themes. Three themes were comprised predominantly of high-importance and low-agreement items: *Disability Characteristics, Legal,* and *UDI.* All seven items under the theme *Disability Characteristics* were rated high-importance and low-agreement. Faculty members apparently felt that it is important to understand the characteristics of all types of disabilities but perceived that this knowledge is not currently prevalent at their university. These findings corroborate previous research reporting that faculty members feel they lack disability-specific information (Houck, Asselin, Troutman, & Arrington, 1992). It is noteworthy that the importance and agreement ratings tended to be higher for more obvious disabilities and lower for less obvious, or hidden, disabilities. For example, Importance/Agreement index scores for hearing impairments, visual impairments, and orthopedic disabilities (i.e., obvious disabilities) were 93/49, 93/47, and 91/41, respectively. Alternatively, Importance/Agreement index scores for learning disabilities, chronic illnesses, psychiatric disabilities, and ADHD (i.e., hidden disabilities) were 91/33, 89/32, 88/24, and 87/29, respectively. This finding is consistent with the report of Cook et al. (2006) that many faculty members perceived their some of the colleagues as not fully believing that "invisible" disabilities are real or merit accommodations.

Another theme that appears to represent an unmet need at the participating campuses is *Legal*. Three of four items under the theme *Legal* were rated high/low. It appears that faculty members feel that it is important to understand the legal mandates but believe that they do not collectively understand the general tenets of relevant laws. These results support previous findings that faculty members possess little understanding of disability law (Benham, 1997; Dona & Edminster, 2001; Thompson, 1997). The one legal item rated high/high focused on physical access on campus. Physical access is quite possibly the most widely publicized and implemented aspect of ADA (Thomas, 2000), and faculty members may be more familiar with the need and mandate for physical access than other aspects of disability law.

The majority of items (five of seven) related to *Universal Design for Instruction* were also rated as high/low. Generally speaking, faculty members' tendencies to rate these items as highly important may be due to the attraction of instructional concepts that potentially benefit students with and without disabilities. The items in this theme were phrased generally, without technical terminology, or even the phrase "Universal Design for Instruction," which may have added to the appeal of the approaches to survey respondents. However, most faculty members do not have training in UDI or in pedagogy in general (Salzber et al., 2002), so it is not surprising that respondents indicated that UDI is not widely implemented. The two items with the lowest agreement index scores noted specific techniques (i.e., "Faculty members are familiar with assistive technology that can facilitate learning" [agreement index of 32%] and "Faculty members provide lecture and course material in a wide variety of formats and media" [agreement index of 46%]), perhaps indicating that university faculty members are

not skilled at implementing specific instructional practices associated with UDI. Alternatively, the two high/high items in the UDI theme appear to be the most general (i.e., "Faculty members have high expectations of success for all students" and "Faculty members ensure that the learning environment enables all students access to the course content").

Low importance and low agreement themes. Faculty members rated the majority of items under one theme, *Accommodations-Willingness*, as low-importance and low-agreement (three of five items). That faculty members rated alternate or extra credit assignments, partial credit for process or allowing a proofreader, and course substitutions or waivers as neither highly important nor as occurring frequently is consistent with previous research (see also Bourke et al., 2000; Sweener et al., 2002). Accommodations tend not to be allowed by faculty members when they are either too time consuming (Bourke et al.) or when they are perceived as changing the nature of the course (Matthews et al., 1987; Nelson, Dodd, & Smith, 1990). It is possible that faculty members felt negatively about these accommodations because they are relatively difficult to implement, perceived as altering the nature of the course, or both. In contrast, faculty members rated two accommodations, extra time on tests and recording lectures, as both highly important and occurring with frequency. Both of these accommodations are relatively easy to apply and are unlikely to alter the fundamental aspects of a course.

Implications and Recommendations

The primary implications of this study for practice lie in generating recommendations for improving the outcomes of college students with disabilities. Across survey items, there was a pervasive gap between respondents' importance and agreement ratings. That is, the understanding of participants and their colleagues about critical issues related to college students with disabilities did not match the importance they placed on the same issues. The discrepancy between where respondents feel that they should be with respect to working with students with disabilities and where they actually are is most pronounced in the themes comprised of predominantly high/low items (i.e., *Disability Characteristics*, *Legal*, and *UDI*). These high/low areas appear well suited for targeted intervention, in that faculty members believe they are important but recognize that their collective understanding is relatively low. Indeed, they coincide with recommendations for faculty training made by directors of Offices of Disability Services (Salzberg et al., 2002).

It appears that faculty members' understanding of issues tended to decrease as the specificity of the items increased. For example, 90% of respondents agreed with the rather general statement that faculty members understand that students with disabilities must have physical access to buildings on campus. Alternatively, only 38% of participants agreed that faculty members know what to do in the specific instance of when a student is unhappy with the accommodations being provided. As such, we recommend that training and information disseminated to faculty members regarding college students with disabilities address specific issues about which faculty members do not have adequate understanding, rather than focusing solely on changing attitudes or on general, conceptual issues. Faculty members clearly need specific knowledge in areas such as disability characteristics, disability law, and instructional techniques to reduce the gap between their priorities and their understanding.

Although it seems logical that the high/low themes and items be the primary focus of training and information dissemination at participating campuses, it is also critical that the high/high strengths be maintained. In order to accomplish this, training should also provide attention to issues related to disability etiquette and policies regarding accommodations. Further investigation into low/low items appears needed before being featured in training and information. The majority of low/low items consisted of accommodations that faculty members are not generally willing to grant students. In fact, if these accommodations violate the academic integrity of their course, faculty members have a right to not implement them. Focusing training and providing information on issues that faculty have not expressed a desire to learn and may not be legally required to enact is likely an inefficient and counter-productive use of scarce resources.

The *Faculty Priorities and Understanding Regarding College Students with Disabilities Scale* is a unique instrument, in that it measures both faculty members' priorities and understanding toward critical issues regarding college students with disabilities. The instrument also expands the literature base by examining faculty members' priorities and understanding of important areas not investigated by previous research (i.e., disability etiquette, UDI, and knowledge of disability characteristics). Thus, the scale can be used by institutions of higher education to examine and compare comprehensively the priorities and beliefs of their faculty members related to working with students with disabilities.

It will be important that future researchers using the survey increase return rate. For example, return rate might be enhanced by university administrators communicating to faculty members the importance, ease, and safety of responding to the survey before the survey is distributed. Future researchers might also consider rephrasing items, deleting items, or adding

items to improve the reliability of the *Legal*, *Accommodations-Willingness*, and *Disability Etiquette* themes. We suggest that researchers perform a confirmatory factor analysis to empirically test the themes that were derived rationally from the previous literature. Future researchers may also be able to assess the validity of the *Faculty Priorities and Understanding Regarding College Students with Disabilities Scale* by examining the degree to which participants' responses correspond with observations of faculty behavior and/or the perceptions of students with disabilities. Involving a larger and nationally representative sample would allow for a variety of interesting comparisons regarding the priorities and understanding of faculty members across different types of institutions (e.g., two-year vs. four-year institutions) and geographical locations (e.g., North-East vs. South-West).

Limitations

It is important that the findings of this investigation be considered in the context of a number of limitations. All campuses involved in the survey were located in the mid-western United States. The findings may not generalize to other locations or populations. Additionally, the response rate to the survey was 14%. It is possible that important differences exist between those who chose to respond and those who did not. The low return rate may have been due to at least two factors. Return rates are typically lower for internet surveys than traditional mail surveys (Shermis & Lombard, 1999) and may be especially problematic for professional respondents. For example, McKinley, Rogers, and MacLean (2003) reported a return rate of 2.2% for an online survey conducted with physicians. Additionally, not long before the survey was e-mailed, the university had experienced a number of e-mail viruses and had issued a warning not to go to links provided in e-mails from unfamiliar senders. Many faculty members, then, may have decided not to click on the link to access the survey for fear it was a virus. Findings are self-reports of personal beliefs and of the current state of practices at the university. Although the straightforward nature of the questions supports the face validity of the scale, respondents might not be accurate in their reports of what is occurring and what they believe is important (e.g., they might be giving politically correct responses). Another important limitation to the study is that the Cronbach alpha coefficients of some of the themes on the survey instrument fell slightly below .80, which is generally considered to denote adequate reliability (Nunnally & Bernstein, 1994). Nunnally and Bernstein suggested that reliability coefficients ranging from .70 to .79 be considered modest. Accordingly, findings regarding the *Legal, Accommodations-Willingness,* and *Disability Etiquette* themes should be interpreted cautiously.

Conclusion

Three hundred and seven faculty members from eight post-secondary campuses in the Midwest indicated that accommodations policies and disability etiquette were predominantly highly important and were being addressed satisfactorily; that issues related to law, Universal Design for Instruction, and disability characteristics tended to be viewed as important but were not addressed satisfactorily; and that issues related to willingness to provide accommodations were generally perceived as neither highly important nor being addressed satisfactorily.

People with disabilities have made remarkable strides in contemporary society (Shapiro, 1994). Among those achievements is increased access to post-secondary education. Succeeding at colleges and universities entails a number of meaningful advantages to people with disabilities (United States Department of Labor, Employment, and Training Administration, 2004). As such, it is critical that university faculty members make every reasonable effort to provide students with disabilities opportunities to succeed. The first step in accomplishing this goal is assessing faculty members' priorities and understanding of critical issues, which we have done for an eight-campus system in this research. The next steps are formulating an action agenda to address the issues raised and providing the resources, organizational support, and effort to implement the recommendations.

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Understanding Tertiary Student Learning: Are They Independent Thinkers or Simply Consumers and Reactors?

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The central place of the learning environment and the personal characteristics of the learner in influencing whether students adopt deep or surface approaches to learning is well evidenced in the literature (for example, Marton & Saljo, 1976; Biggs, 1987; Entwhistle, 2001; Ramsden, 2003). For this reason, tertiary educators are constantly seeking opportunities to provide best practice in their university classrooms. Yet simply motivating students to participate in class does not necessarily alter overall learning styles (Herington & Weaven, 2008). Although the term "learning style" is somewhat problematic (Richardson, 2000), previous research has shown that students' tendency towards a particular learning strategy affects their learning-related performance (Heikkila & Lonka, 2006). This suggests that the process of "unlearning" previous learning styles may pose a significant problem for academics if they hope to change their students' learning processes from surface to deep learning. As a profession, teaching at the tertiary level obviously draws upon a formal knowledge base. An important step in the translation of the formal knowledge base to enlightened practice is to draw upon tertiary students' experiential and informal knowledge. What learning-related concepts, and misconceptions do they hold? What is going on in the students' minds? Specifically, this paper will provide information on how three pre-service students currently enrolled in a Bachelor of Arts (Primary) course at the Sultan Hassanal Bolkiah Institute of Education (SHBIE), Univeristi of Brunei Daurssalam, Brunei Darussalam, approach study and how this approach can affect their concepts of learning.

Few individuals would deny that learning is the primary purpose of higher education and that teaching is the foremost means by which that goal is accomplished. Within the educational context of the courses in which the author was engaged to teach at the School of Educational Psychology, Sultan Hassanal Bolkiah Institute of Education (SHBIE) , Universiti of Brunei Darussalam, the two phenomena are so inextricably intertwined that it is often difficult to imagine one without the other.

However, as identified by Boulton-Lewis (1993) and more recently by Perkins (2006), much of the knowledge about teaching and learning within the tertiary arena is fragmented. This fragmentation restricts both the understanding of these important processes and the extent to which the relevant knowledge base can influence educational practices in higher degree courses (Ramsden, 2003). Teacher competencies and the quality of higher degree teacher education have for some time been of concern in Australia as demonstrated by the establishment and work of the National Project on the Quality of Teaching and Learning and the Council for the Advancement of University Teaching. The goal of this paper is to examine the relationships between approaches to study and the concepts of learning with an eye toward the integration of learning theory and research concerned with the two phenomena.

Specifically, this paper will provide information on how three pre-service students currently enrolled in a Bachelor of Arts (Primary) course at SHBIE, the Univeristi of Brunei Darussalam, approach study and how this approach can affect their concepts of learning. In an effort to investigate the integration and utilization of these students' knowledge of learning, it is first important to briefly address the two main themes of this paper: approaches to study and concepts of learning.

Approaches to Study

The conception of learning that a student holds determines how a student learns and what is learned by that student (Creanor, Trinder, Gowan and Howels, 2006; Biggs & Telfer, 1987). Tertiary students come to the learning situation with previously constructed ideas, knowledge or beliefs that help make sense of new information (Entwhistle, McCune & Hounsell, 2002; Schallert, 1982). By the time students enter tertiary education, they more than likely have a consistent way of going about learning and studying. In general that approach to study is derived from the student's metacognition, linking motive and strategy with perceived task demands and desired type of learning outcome.

According to Herington and Weaven (2008), approaches to learning are related to the degree of satisfaction that students experience in their learning. Elliot & Dweck (1988) discussed this balance from two perspectives, a master/learning orientation and a performance/ego orientation. According to Dweck (1999), a mastery/learning goal orientation focuses on attaining competence through learning, understanding, and task mastery as measured by self-selected standards, development of new skills, and the seeking

of new challenges. On the other hand, a performance/ego goal orientation focuses on looking competent, demonstrating ability relative to others, and avoiding negative evaluations (Dweck, 1999).

This work was mirrored to some extent by Biggs and Moore who in 1993 identified three distinct approaches to learning: deep, surface, and achieving. Just like motives and strategies, a student's approach to study can be referred to as deep, surface, and achieving, with deep-achieving and surface achieving as other possible combinations.

The Deep Approach

Students who adopt a deep learning approach are interested in the academic task, relate the task to themselves, integrate parts of the task into the whole, and try to theorise about the task (Ramsden, 2003). In addition, students adopting this learning approach actively engage with course content and attend to the meaning and significance of the materials to be studied (Fox, McManus & Winder, 2001; Marton & Saljo, 1976). Because these students attempt to maximise their understanding by reading widely, discussing, and reflecting on the topic, the deep approach to learning usually leads to structurally complex performances and to high grades.

The Surface Approach

Alternatively, students who adopt a surface learning approach see the task as a means of achieving an end, such as gaining a good mark. However, the flip side to this approach is that it generally leads to poorer learning outcomes (Ramsden, 2003). Such students do not relate aspects of the task to a whole, worry about the time pressure involved, and avoid personal meaning (Slee, 1993). The surface learning approach incorporates the use of routine memorization (i.e., rote learning) to recall course content (Entwistle, 2001). Therefore, while the surface approach to learning is generally effective for recalling unrelated detail, it may result in low grades, particularly if students are required to apply those recalled facts in a problem solving task.

The Achieving Approach

Biggs and Moore (1993) also take into account students who adopt an achieving approach to learning. For these students, the purpose of learning is to gain academic qualifications or to gain the highest mark. Such students are concerned with the skills that will optimise the organization of the time and effort that they put into their study. "Achieving" describes a student's need to achieve high grades and be visibly seen to achieve (Entwistle, & Tait, 1994). The achieving approach to learning usually leads to high grades as the students who embrace this stratagem will allocate time to tasks in proportion to their grade earning potential (Slee, 1993).

Summary

"The link between a person's belief's about what learning is, and how that person will engage in a task, is a strong one" (Biggs & Moore, 1993, P. 317). Van Rossum and Schenk (1984), for instance, found that surface learners overwhelmingly held a quantitative conception of learning. That is, surface learning approaches are often associated with rehearsal behaviour, and they often result in fatigue and a dissatisfying learning experience (Ramsden, 2003). Meanwhile, deep learners hold a qualitative conception to learning and are more likely to be interested in the task itself, to engage in personal reflection, and to search for inherent meaning within the task. Such a learning approach frequently results in reports of high levels of learning satisfaction **(**Lonka, Olkinouora, & Makinen, 2004).

Ramsden (1992) advocates that "good teaching implies engaging students in ways that are appropriate to the deployment of deep approaches" (p. 61). Similarly, Biggs (1999) and Karns (2005) suggest, that to change a student's approach to study, it is necessary to induce an appreciation of higher conceptions of learning through the teaching environment. Good teaching should minimize those factors that lead to surface learning and should maximise those factors leading to students adopting deep and achieving approaches to learning.

Approaches to Learning

Adapting learning styles has also been found to be related to the students' perception of what is required in a course. Marton and his colleagues at the University of Gothenburg (Marton, 1976; Marton & Salijo, 1976) have approached the study of student learning from a phenomenological stand-point: *What a student learns can only be gauged from the student's own perspective.* This viewpoint has a further corollary, as Marton believes, that learning can only be evaluated in terms of the content of learning. A learning "process," over and above the content learned, might be a useful abstraction for psychologists to use, but it has nothing to do with assessing a particular interaction, here and now, between a student and the content she or he is studying.

This notion led Marton to assess learning in terms of what students said they understood from a particular learning episode (e.g. reading a short passage, or answering a question that poses a problem requiring specific knowledge for its solution). In general, Marton

(1997) found that students' responses could be classified into four levels, each level showing increasing grasp of the complexities of the material (see also Marton & Sailjo, 1976). As it turned out, these levels were virtually identical to the first four SOLO levels (Biggs, 1980, 1987).

Student Learning and the SOLO Taxonomy

Biggs and Collis (1982) developed a system of learning which summarises possible learning outcomes called the Structure of the Observed Learning Outcome (SOLO) taxonomy. SOLO is based on neo-piagetian ideas and has been influenced by information processing concepts. The SOLO taxonomy is aimed at detecting the quality of students' learning by finding out where the student is in terms of a cycle of learning. The cycle of learning (or the taxonomy) describes five general levels of learning outcomes that range from incompetence to expertise (Biggs and Telfer, 1987).

Biggs and Collis (1982) developed the SOLO taxonomy as a means of evaluating the quality of student learning outcomes. As an analytical tool, the SOLO model has the potential to evaluate student responses and to distinguish qualitatively different levels of student performance along a developmental continuum (McPhan, 2008). This taxonomy has been widely used in educational research as a means of determining the complexity and depth of student learning outcomes (Hawkins & Hedberg, 1986;; Tang & Watkins, 1994; Holmes, 2004).

Within the SOLO model (Biggs & Collis, 1982; 1991), student responses can be classified according to five levels of inherent complexity. Responses may be classified as prestructural, unistructural, multistructural, relational, or extended abstract (Biggs & Collis, 1982). Each level is related to the number of elements which are evident in a student's response. In the following section, adapted from Boulton-Lewis (1993) and Slee, 1993), the five levels are modified to apply to knowledge of learning. These levels are

1. Prestructural - At this level in the cycle, the student can attempt a set task, such as answering a question, but is capable of very little else. There is no evidence of any knowledge of the process involved in learning and the likely response is, "I don't know."
2. Unistructural - At this level in the learning cycle, the student will focus on the question posed or the activity to be learned. Typically he or she will focus on just one relevant aspect of learning which is understood.
3. Multistructual - Here the student can attend to more than one aspect of the task, and several relevant independent aspects of learning are presented. However, these are not integrated into an overall structure.
4. Relational - According to Biggs & Telfer (1987) the relational level in the cycle is a higher level of functioning that enables the student to attend to parts of the whole in an integrated fashion. Consequently, relevant aspects of learning are integrated into an overall structure.
5. Extended Abstract - At the highest level, the individual is using abstract reasoning to think about strategies and tactics involved in the task and to appreciate the aesthetics or underlying philosophy. Thus, the integrated knowledge of learning is generalized to a new domain.

Summary

Biggs and Telfer (1987) place a great deal of emphasis on the concept of the learning cycle, arguing that it is a process through which an individual moves in learning a task. They believe that overall the SOLO taxonomy has a wide application in the learning setting (Power, 1986). The sequential progression through the learning cycle towards levels of higher abstraction in an ever upwards process has been termed the course of optimal (cognitive) development (Biggs & Collis, 1989). In later developments of the SOLO model, there have been refinements to incorporate linear development within a mode. This is known as 'unimodal' learning, and development across the modes has been termed as 'multimodal' learning **(**McPhan, 2002). For an overview of the SOLO model in terms of modes, learning cycles and forms of knowledge see Mc Phan, 2008.

Method

The aim of this paper was to investigate the approaches to study and the conceptions of learning of three pre-service university students. Who are these learners, how do they learn, and what kind of learning strategies are they using? There are just a few of the questions which this project set out to investigate. The methods and procedures used in this study are outlined below.

Participants

The subjects consisted of three pre-service education students enrolled in a Bachelor of Arts (Primary) program at the School of Educational Psychology (SHIBE) Universiti of Brunei Daurssalam. In semester one, 2006, 36 students enrolled in the unit PP 3212 – Inclusive Education.

Of the 36 students who were initially invited to participate in this investigation, twelve students nominated their interest in involvement in the study.

From those 12 responses, 3 students were randomly selected to participate in this study (i.e., every fourth respondent was chosen). The 3 students – 2 females, Kym and Sam (aged 19 and 20 years respectively) and 1 male, Milo (aged 20 years) – participated fully in the study. Pseudonyms have been used throughout this paper to protect the identity of the students.

Procedure

An introductory letter explaining the aims of the study and what was involved was distributed to the students enrolled in the unit PP 3212 Inclusive Education during the first week of semester one, 2005. During the first PP 3212 tutorial, students were invited to nominate if they wished to be fully involved in the study. Three randomly selected pre-service primary teachers were then invited to participate in this study.

The author interviewed the students individually and audio-taped the students' responses which were based on a semi- structured set of questions regarding the nature of learning concepts. A sample of the questions are: *What is Learning?, When you learn something yourself, how do you learn? What influences the way that you learn? What do you think is the role of the student in learning?* The final question was open ended*: If you could finish the sentence, "Learning is……" How would you finish it?* The major focus of the interviews was on how these students understand learning and their approach to learning.

The data was collected through separate face to face interviews conducted by the author in a quiet classroom at the university. The students were interviewed on one occasion, and all interviews were undertaken within the same week. Each interview took between 30 – 45 minutes. The students gave their permission for their interview to be audio-taped. The interviews were transcribed by the author within one week of each interview, and then members checked (Lincon & Guba, 1986) for quality assurance purposes so as to create reliable and trustworthy data.

Data Analysis

The interview questions were open-ended, and the data was interpreted in two ways. The first method of analysis used a phenomenographical approach (Marton, 1994). The second method interpreted the students' responses from the perspective of the SOLO model (Biggs & Colliers, 1982). The use of graphical forms of representation – such as a table or a matrix – has been proposed for some time (e.g., Miles and Huberman, 1994; Nadan & Cassell, 2004; Schwab, 2005) as being useful in unpacking the complexities of interview data. Consequently, tables were used in this paper to organize and depict the qualitative research findings in relation to the two approaches used to analyse the data.

In the first instance, a phenomenographical approach to analysis (Marton, 1994) was adopted in order to elicit the highly personal views which the study required. As the study focused on the very broad area of approach to learning, it was important to explore the students' conceptions of learning in everyday life and how this in turn might impact on their approach to learning at university. Consequently, an interpretive phenomenological approach was selected to encourage openness and informality during the interviews.

Interpretive phenomenological analysis has to date been mainly used in health and psychology disciplines (Reid, Flowers, & Larkin, (2005). It relies on a very open approach to interview, as well as on the assumption that the interviewee is an expert on his or her own experience. It does not seek to test assumptions, but rather depends on the emergence of themes as the interview progresses (Creanor, Trinder, Gowan & Howels, 2006). In line with this approach, Marton (1981) and Marton, Dall'Alba & Beaty, (1993) found that learning generally was understood in six qualitatively different ways: increasing one's knowledge, memorising and reproducing, applying, understanding, seeing something in a different way, and changing as a person.

The second method of analysis, the SOLO Taxonomy (Biggs & Collis, 1982), was used to assess the students' general conceptions of course work (Prosser & Trigwell, 1991; Trigwell & Prosser, 1991a, 1991b) and for assessing students' understanding of content taught and their knowledge of learning (Boulton-Lewis, 1993). The SOLO taxonomy has previously been used to examine interview data to ascertain the degree of deep learning that has occurred throughout a university course (Slack, Beer, Armitt & Green, 2003). These authors believe that the strength of the SOLO model is in delineating conceptual processes.

In addition, Boulton-Lewis (1993), Chan, Tsui, Chan & Hong (2002), and Holmes (2004) have also applied this taxonomy to the knowledge of learning at the tertiary level. Each of the 3 student interview transcripts in the current study was classified from pre-structural to extended abstract depending on its complexity and relevance to the discussion. The consistency of the codings was checked for interrelater reliability by a research assistant and the author.

Table 1
The Categorization of the 3 Students According to Their Approaches to Study

Name	Approach to Study	Application to Learning
		Examples from students' interview transcripts
Sam	Surface-achieving	I would learn it for the exam or know enough to be able to at least pass my assignments, but I would not do any more than I had to on that subject. I would do what I had to do.
Kym	Surface-achieving	I would have to go back and memorize it if there was a test. I did learn it. In fact I learnt it again last night because I have done this before in another course, and I think I could maybe pass a test on it. But in a few weeks – I would have to relearn it again because I do not need to use it right now.
Milo	Surface-achieving	Well, if the topic is boring and frequently they are, unfortunately. There is an expectation that it will be interesting - but pretty much I take quite a mercenary approach to it. I think, "What is the bare minimum that I have to do to meet all the requirements?" and I will look into things that I find interesting in my own time.

Table 2
The Categorization of the 3 Students According to Their Conceptions of Learning

Name	Conceptions of Learning		Application to Learning
	Phenomenological	SOLO Taxonomy	Examples from students' interview transcripts
Sam	Memorizing and reproducing	Uni-structural	Because basically someone is teaching you something and if you can reproduce it – either on paper, or say it, or teach someone or tell someone about it, well that shows that you have learnt it. Otherwise you haven't.
Kym	Applying, understanding	Multistructural	Learning is the processing of new information and the filtering of any new information at it comes into your head.
Milo	Applying, understanding	Multistructural	Learning is knowing about many different types of knowing. But it is especially about knowing when you don't know how to know, and how to find those skills, to know.

Results

The major focus of the interviews was on how the students interpret their learning and their understanding of learning. All of the students interviewed appear to use a surface-achieving approach to their tertiary study. Table 1 identifies segments of the participant's interview transcripts characterizing this preferred approach to learning.

Table 1 illustrates that the three students' approach to learning resulted in a surface approach to their university assignments. Work pressures from university assignments and part-time work obligations were cited as reasons for tardiness. As previous research has shown, perceptions of being pressured coupled with limited time to meet deadlines, work against deep approaches to learning and the associated extended reflective activity that facilitates deep processing and the personalization of knowledge (Biggs, 1987; Entwistle, McCune & Hounsell, 2002).

Table 2 substantiates the participants' conceptions of learning phenomenologically and by means of utilizing the SOLO taxonomy. After this analysis, results indicate that two students hold multi-structural conceptions of learning and one student holds a uni-structural conception of learning.

Results reported in Table 2 imply that the quality of learning outcomes may be improved through the provision of a learning environment characterized by learning activities and teaching strategies designed to promote students' control of their own learning, constructivist approaches to learning, and relational understanding of the material. That is, there is evidence of a positive relationship between the conception of teaching, teaching approach, and student learning outcomes.

Reflecting on Active Understanding

When reflecting on their teaching and learning, to what relative extent do tertiary students draw on their own experience as learners, or their informal knowledge of learning, or their taught knowledge? Perkins (2006) believes that students in under-graduate

teacher education programs (such as the Bachelor of Arts (Primary) at the Universiti of Brunei Darusalam) bring with them considerable informal declarative knowledge of learning processes and of psychological concepts related to classroom learning. Such knowledge is of two kinds: general conceptions of learning and teaching and specific concepts about learning and teaching. Of central issue in the case of post- service teachers is that it is important what beliefs such university students hold about their learning, because such cognitions are very likely to determine either effective teaching and learning practice or counter-productive classroom practices.

Reflections on How Participants' Approaches to Study Are Related to Conceptions of Learning

Clearly the three participating students' conceptions of learning are influenced by two major views. The first is a belief that learning is a constructive rather than reproductive process (Biggs & Moore, 1993). That is, the learner does not merely record the material to be learned. Rather, the learner constructs his or her own mental representation of the material to be learned, selects information perceived to be relevant, and interprets this information on the basis of his or her existing knowledge and current needs, adding information not explicitly provided in order to make sense of the new material.

Below are some examples from the participant's transcripts which support this notion. Although the theme of constructivism runs through all three interviews on learning, there is considerable variation in the philosophical and theoretical underpinnings of the various perspectives taken by the three students involved in this study.

> At high school, I enjoyed science and maths subjects. I would always write it. I write it down. All of my formulae are written down. My work would be done on paper. That would be at high school level. Now for my Uni, if I am learning something, I think about it. Are the concepts clear to me? If it is clear to me in my mind, if it is clear to me – then I have learnt it (Sam).

> All of my undergraduate, all of my education and even in life interaction – something is being filtered in and you are always processing new information – and obviously my University courses have helped that. Learning is life long – every interaction, what your read, what you see, write, anything is learning. You are processing it. It is coming into your head and you are learning (Kym).

> I see teachers as facilitators - they are to gently help students to make the connections but not giving them a formal structure and not in an overbearing way. It must be gentle. I think that is so exciting to be able to do that. It is about life-long learning (Milo).

The second major view held by the three participants in this study is that learning is primarily a social, cultural and interpersonal process that is influenced as much by social, emotional and cultural factors as by cognitive ones. Once again, there are variations in the perspectives taken by different investigators, with some emphasizing social-psychological issues (Goodenow, 1992), whereas others emphasize the sociolinguistic and sociocultural issues (Collins & Green, 1992).

This concern for the social context of learning clearly needs to be added to the suggestion that the meaningful learning of complex material (in contrast to the acquisition of isolated information, which in certain cases is still necessary) may be characterized as being active, constructive, cumulative, self-regulated, and goal oriented (Shuell, 1986, 1988, 1990).

The following segments from the participants' transcripts, exemplify this notion of the social context of learning.

> It is giving them the knowledge, telling them but it is also about guiding them to further ideas. Picking those who have an interest to go further, selecting those who have the ability to go further,r and giving them more work. But at the same time, for those who can not understand it – to encourage the ones who can do a bit more and support them as well. It is giving more to those who have the ability and supporting those who are having trouble (Sam).

> I learn best by interacting, I need a high interest level, the size of the group that you are learning in – I learn best in small group settings. The learning environment is important to me. I learn through understanding and a good mood influences my learning (Kym).

> I size up the politics of what I am learning and who I am learning from, and I would go to someone who was an expert in whatever it was that I did not know and ask them to help me to develop my skill in that area. Knowing when you don't have the skill to learn something and then knowing who to approach and who will help you in a safe way. That's the big thing (Milo).

The learner-centred orientation inherent in the three students' views of learning has important implications for instruction, including increased emphasis on self-regulated learning (e.g., Corno, 1987; Zimmerman, 1989; Zimmerman & Schunk, 1989) and studying (eg. McClintock, 1971; Rohwer, 1984; Thomas, 1988). However, for purposes of learning from instruction, perhaps in the tertiary arena more emphasis needs to be placed on the instructional variables that influence learning (Shuell 1988, 1992).

Factors which Seem to Influence Tertiary Students to Adopt a Surface or a Deep Approach to Learning

All of the participants interviewed characterized their approach to study at University as being a surface-achieving approach. These students tend to value achievement and would view their ability as improvable. They tend to attribute their success to effort, use of the right strategy, and obtaining sufficient knowledge. However, these students tended to lack a strong sense of their own competence. Consequently, it is expected that their own self-worth would often separate them from their performance. In other words, they probably feel only as smart as their last essay mark or their previous semester's grade.

Attribution theory (Weinstein, 1991) suggests that the explanations people give for study behaviour, particularly their own successes and failures, have strong influences on future plans and performance. One of the important features of an attribution is whether it is internal or external and beyond control (Ramsden, 2003). All three students talked about not being able to retain material learned in subject areas outside of their chosen field (e.g., History, Maths, English etc). As pre-service School of Education students, they have clearly found a pattern of effort and strategy which works for them and one by which they achieve significant success. The following statements highlight these students' approaches to learning.

> Well the motivation would be to complete my BA. If I had to do it, I would do it. I would spend as much time on my assignments and on my research, everything that needed to be done would be done because I know that my degree was dependent on that. But I would forget about some parts of the course, once I had my degree (Sam).

> I like Uni, but I there are some aspects of courses that I don't think I need. For instance, statistics. I may need to know about standard deviations if I go on to do a PhD. Then I will need that. But at the moment I don't see the need to learn that. So I feel that I am learning about statistics differently to other information. I know I will just forget it after the test. It was just one of those lessons that had to be learnt and it had to be taught, but it is not one of those things that I feel I need now (Kym).

> I don't read from cover to cover. I read the footnotes, the intro, the conclusion. I read widely but I get bored and I jump all over the book. I twist a situation to fit into a structure. I go for what looks good and what's effective and what meets the criteria. Somehow, I always manage to do pretty well in my subjects that way (Milo).

Lecturers may cue students' attributions by the way they respond to their students' work. If tertiary students believe that their ability is fixed, then they tend to set performance goals and strive to protect themselves from failure. In this way, their explanations, justifications, and excuses influence their motivation and study behaviour. For example:

- If I had to do it I would do it……But I would forget about it once I had my degree
- It is not one of those things that I feel I need right now, and
- I twist a situation to fit into a structure……I go for what looks good.

Surface-achieving students (such as the participants in this study) may choose to enroll in subjects and indeed courses in which they feel they have a better than reasonable chance at passing. That is, they believe that they would have a good chance at success in a particular tertiary course without having to move out of their approach to study comfort zone. However, as Biggs and Moore (1993) have identified, when students believe ability is improvable, they tend to set learning goals and handle potential failure constructively.

Thus tertiary educators need to know beyond expert knowledge of their subjects and the pedagogy of teaching and managing students. Tertiary educators need to know how their higher degree students learn in classrooms and how they approach their study. Further, university lecturers must comprehensively understand theories of knowledge acquisition and the social nature of learning in classrooms to define and clarify their roles as effective tertiary educators.

Conclusion

Historically, the difficulties in defining learning at the tertiary level have been attributed to attempts to consider the concept of learning as a single phenomenon: the acquisition of knowledge (Martin, Prosser, Trigwell, Lueckenhausen, and Ramsden, (2001). As a result, researchers in the past have looked for common elements amongst learning activities

(Saljo, 1988). The problem with viewing learning in this way has become apparent with the mounting realization that tertiary students' learning and remembering are crucially affected by what they already know (Hollingsworth, 1989).

Tertiary students come to the learning situation with previously constructed ideas, knowledge or beliefs that help they to make sense of new information (Schallert, 1982). Students (such as the participants) who are part way through their under-graduate teacher education programs, for example, have definite ideas about teaching and learning, although their ideas cannot always be articulated (Lonka, Olkinouora & Makinen, 2004; Zeichner & Liston, 1987).

That is, pre-service education students begin with loosely formulated philosophies of education that personally explain what they think lecturers do and how tertiary students learn in classrooms (Buchmann & Schwille, 1983). These perspectives serve as culturally based filters to help make sense of the university program content, their roles as students, their observations of lectures and tutorial classrooms at work, and their translation of program content into teaching/learning activities in tertiary courses (Hollingsworth, 1986, 1989; Nespor, 1985).

According to Perkins (2006), "…our everyday way of talking about understanding is dominated by metaphors or possession. We speak of having, or of possessing an understanding, of acquiring knowledge, as though it was something stored in the basement. We speak of grasping something, which is a metaphor of taking possession. Or informally, we speak of 'getting it' – as in 'You either get it or you don't'. In this notion either one manages to take possession of a complex concept or if not: it slips through one's fingers and it's gone" (p. 29). This language, though, is completely alien to personal understanding that unfolds over time with greater effort and thoughtfulness.

Consequently, beyond knowledge of the subject and pedagogy of teaching and managing students, lecturers need to know how higher degree students learn in lectures and tutorials. That is, lecturers must comprehensively understand both theories of knowledge acquisition, approach to study, and the social nature of learning in classrooms to define and clarify their roles as effective "teachers" in the tertiary learning environment.

A commitment to quality teaching and learning includes a responsibility to voice and lead the development of quality practices beyond an individual academic's own units. The design of every teaching and learning sequence should be informed by a careful analysis of past student feedback, particularly with regard to the type of things that would motivate them as individuals and as a group to become engaged with the material. Effective tertiary educators need to try to ensure that students feel valued for their comments on their lecturers' approach to teaching and learning. In summary, it needs to be the aim of all academics to develop their students as independent thinkers rather than simply consumers and reactors.

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Group Peer Review as an Active Learning Strategy in a Research Course

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The faculty of an undergraduate research course with a diverse student body recognized that many students struggled with the concept of how to critique a research article. The traditional assignment method used to teach the critique process did not maximize student learning outcomes. The active learning strategy of peer review was used to enhance student understanding and engagement in the critique process. This active learning strategy involved small groups of students who worked together as a team to evaluate the work of other student groups using a critique-rubric. This article describes the development and incorporation of a peer review activity into an undergraduate research course.

Faculty who teach at the college level are often faced with the challenge of how to facilitate higher levels of student engagement and learning among undergraduate students. More than 20 years ago, based on research on college teaching and learning, Chickering (1987) identified the use of active learning strategies as a key part of good practice in undergraduate education. The concept of active learning has been identified in the literature as a useful methodology for helping students to be actively involved in their own learning, attain complex objectives, think critically, and solve problems (Bonner, 1999; Bonwell & Eison, 1991; Page, 2001; Vos & Graaff de, 2004). Examples of active learning include, but are not limited to, peer review, pair shares, role playing, debate, case studies, and cooperative learning (Bonwell & Eison, 1991). The philosophy of active learning fosters student engagement by emphasizing students' responsibility for their own learning as well as that of their peers. When the emphasis shifts from students being passive recipients of knowledge, a higher level of learning is thought to occur. This higher level of learning is based on the principles of metacognition (Vos & Graaff de, 2004).

The purpose of this article is to describe how the faculty of an undergraduate research course incorporated the active learning strategy of peer review into a classroom activity that involved the critique of a research article. Peer review, or peer evaluation, within the context of this paper, is defined as the involvement of students in the evaluation process of other students' work (Pond & Ul-Haq, 1997; Rieber, 2006; Topping, 2005; van den Berg, Admiraal, & Pilot, 2006). This project contributes to the literature on active leaning strategies because there is a paucity of practical information on methods that can be used to integrate active learning strategies into undergraduate research courses.

Review of Literature

Traditionally in the undergraduate nursing research course, students were taught conceptual principles of research and then were asked to critique a research article on a topic of their choice. Students then submitted a rough draft of their critique to the instructor for constructive feedback. Faculty evaluated each individual critique and gave students written feedback. The students then had the opportunity to revise and resubmit their papers for grading. The faculty recognized that many students struggled with the process of how to critique a research article. In addition, the current process did not maximize student learning, did not facilitate higher levels of learning, and did not actively engage student learning. Therefore, the faculty modified the critique assignment so that it incorporated an interactive peer review activity into the research article critique assignment.

Active Learning

Active learning provided the framework that guided this project. Important characteristics of active learning are: 1) active engagement of students in learning, 2) students taking responsibility for their own learning, and sometimes for the learning of others, 3) teachers providing activities that facilitate active learning, instead of simply transferring information (Bonwell & Eison, 1991; Kane, 2004; Page, 1990). Active learning activities promote a higher level of learning through an emphasis on students' abilities to control their learning environments and develop interdependent or cooperative relationships with other students (Vos, 2001). Active learning promotes a higher level of learning through the process of metacognition. The concern of metacognition goes beyond students' identification of their knowledge level to a focus on the learners' insight regarding what they know (Flavel, 1979, Hacker, 1998). In higher education, active learning has been used in a variety of educational programs such as web-based learning (Lohr & Ku, 2003), biology (Allen & Tanner, 2005; Smith, Stewart, Shields, Hayes-Klosteridus, Robinson, &Yuan, 2005), online learning environments (Johnson & Aragon, 2002), and engineering (Anthony, 1996; Vos & Graaff

de, 2004). Duron, Limbach, & Waugh (2006) asserted that faculty should provide multiple opportunities for students to engage in the analysis, synthesis, and evaluation levels of Bloom's taxonomy since active learning in these levels helps students think critically.

Peer Review

For the purpose of this project, peer review – also known as peer evaluation or peer assessment – is defined as a teaching strategy that involves active participation of a student in the formative evaluation of another student's work (Pond & Ul-Haq, 1997). The use of peer review as a form of assessment to evaluate learning is well documented in the higher education literature. Prins, Sluijsmans, Kirschner, and Strijbos (2005) purport that formative peer assessment is an effective way to assist students to develop the skill of providing valuable feedback and suggestions for performance improvement to another person or group in any situation. They contrast the formative peer assessment process with other assessment approaches used in higher education for purely summative purposes. Formative peer assessment helps students identify their strengths and weaknesses, develop and manage their learning processes, and work toward achieving the specified learning outcomes during the learning process itself (Gueldenzoph & May, 2002; Nicol & Macfarlane-Dick, 2006; Prins et al., 2005; Weimer, 2003).

Other researchers have used peer assessment as a specific form of collaborative learning in which students work together in small groups toward a common goal (Dillenbourg, 1999; Strijbos, Martens, & Jochems, 2004). Continuous formative feedback to the group allows students to modify behavior to assure their end product (Prins et al., 2005). The provision of summative feedback by the faculty at the conclusion of the learning experience is important. This feedback includes instructor evaluation, peer evaluation by members, and a self-evaluation by each participant. The collaborative process will then be evaluated by the students to determine whether or not they thought the process was fair. Evaluation is particularly enhanced when peer review is added to the formative evaluation process. This allows peers to work collaboratively to assess each other's work. Peer assessment used in this way assists the students in developing their negotiating skills as well as their critiquing skills.

Peer evaluation can be an effective method of collaborative assessment (Gueldenzoph & May, 2002). It helps prepare students for the upcoming real-life experiences of giving and receiving feedback in the workplace (Gueldenzoph & May, 2002; Nicol & Macfarlane-Dick, 2006; Prins et al., 2005). In order for students to effectively participate in peer evaluation, they need to know who will evaluate them, what the evaluation will include, when the evaluation will be done, why peer evaluations are being done, and how these peer evaluations will affect their grades (Gueldenzpoh & May, 2002).

To ensure that the peer review experience is a meaningful one for students, evaluation tools that explain the assignment's criteria are critical prior to the collaborative experience. In addition, several conditions identified by Lisk (as cited in Reese-Durham, 2005) as essential to cooperative learning are required: "… (a) a clear set of learning objectives that are accepted by all students, (b) positive interdependence, (c) positive social interaction behavior and attitudes, and (d) individual accountability." Reese-Durham (2005) used these conditions as a basis for her use and study of peer review in an educational research course. Evaluation tools then need to be shared with students so they will know how they will be evaluated. These components were a major consideration in the planning of this classroom research project.

In summary, the peer review process involves building a foundation in the classroom that supports collaborative evaluation and helps students relate to and practice real-life situations. In order for peer evaluation to be effective, faculty need to prepare and explain to students the who, what, when, how, and why of the collaborative experience so students feel capable of evaluating one another effectively and fairly.

Implementation of Group Peer Review as an Active Learning Strategy

The purpose of this group peer review activity was to encourage higher levels of thinking and collaboration among a group of students by incorporating the active learning strategy of group peer review and evaluating its effect on student learning and student satisfaction. A major focus for the nursing program was to help students develop critical thinking and collaboration skills, which they will need as future health care professionals. Developing higher order thinking skills can be challenging when students are exposed to research content for the first time. In order to engage students in the abstract process of research, they were asked to conduct a written critique on a nursing research study that reflected a clinical problem. This activity required students to engage in behaviors at the evaluation level of Bloom's taxonomy.

Thirty senior nursing students who were enrolled in a required one-semester research course participated in the group peer review activity. Students in the research course had completed two semesters of nursing and had some knowledge of clinical practice. The majority of the students were generic nursing students who had not yet taken the state licensing exam for registered nurses.

Approximately one fourth of the students were in the RN to BSN program. The RN to BSN students were practicing registered nurses who had associate degrees in nursing and had returned to the university setting to receive a BSN. All of the students were female, and the mean age was thirty. The diversity amongst these students reflected the varied composition of the entire university. Although the majority of the students were African American, many of them were English as second language and/or first-generation college students.

The group peer review activity involved several steps. First, at the beginning of the semester, each student was able to select a topic from one of six different clinical topics. Students were then placed in groups of five based on their assigned clinical topic. For example, one group was assigned pain, and each individual group member selected a research article pertaining to pain. Each student was required to do a review of literature which consisted of three research articles based on their assigned clinical topic. Students were then asked to select one of these articles to use for their critique assignment. A copy of the selected article was then submitted to the instructor in a PDF file format. These articles were then placed on WebCT so the entire class could have access to them. Using the *Grading Rubric for Evaluating Rough Draft of Research Critique* (Appendix A) that contained key elements of a critique, students developed an individual critique draft on their selected article. These critiques ranged from three to five pages in length.

The second step consisted of dividing the entire class into six separate working groups with five members in each group and each with a different clinical topic. Each group exchanged their five rough draft article critiques with another group and evaluated the other's work. Students prepared for this group activity ahead of time by reading all five articles of the group to which they were assigned for the group peer review. This was necessary in order for them to have time to complete a review of the rough drafts in class. During the designated class time, students then completed the *Grading Rubric for Evaluating Rough Draft of Research Critique* (see Appendix A) on each of the five research articles. The first two columns of the form require a "yes" or "no" response to indicate whether the criteria were met; there is also space available for the reviewer to make comments. Students were allowed the entire classroom period of 2.5 hours to complete evaluations on each of the group critiques. This allowed the group of students about 30 minutes to review each critique. At the end of the classroom period, students submitted all of the group evaluations for each of the critiques to the instructor. Students received points that totaled 5% of their grade for participating in this active learning strategy.

At the completion of the group exercise, each student was required to complete the *Research Article Critique Group Peer Evaluation* (see Appendix B) on the various group members. This evaluation contained five questions and provided an opportunity for students to rate their peers' involvement in the critique process using a Likert-type rating scale. Points were assigned based on the criteria listed on the evaluation. At the end of class, students submitted the rough drafts and the evaluations to the instructor.

The faculty then reviewed each critique using the *Grading Rubric for Evaluating Rough Draft of Research Critique* and the group process *Research Article Critique Group Peer Evaluation.* The following week the students received a hard copy of feedback from faculty and peers along with their grade for the group peer review process. Students then used this feedback to make any corrections or changes to their final papers. At the end of the course, students completed the *Evaluation of the Group Peer Review Process* (see Appendix C) to evaluate the peer review process. The evaluation contained four open-ended questions asking students to identify the positive and negative aspects of the peer review process and suggestions for improvement.

Evaluation of the Group Peer Review Process

After completion of the peer review process, the faculty evaluated the entire procedure. Overall, students were able to follow the *Grading Rubric for Evaluating Rough Draft of Research Critique.* Four students only checked "yes" or "no" and did not include comments on the grading rubric. About a fourth of the students had difficulty identifying whether a study was quantitative or qualitative. Other problem areas were identification of theoretical frameworks and independent and dependent variables. The identification of these problems enabled faculty to help students move from lower to higher levels of thinking on Bloom's taxonomy.

While using the *Research Article Critique Group Peer Evaluation*, all students gave their peers top scores of ten in regard to all five questions that rated preparation and participation in the group process. The faculty knew that these peer evaluations were not always accurate because they noted approximately 20 percent of the students had not read the assigned articles prior to participating in the peer review process. It should be noted that the peer reviews were not anonymous.

Based on the students' feedback using the *Evaluation of the Group Peer Review Process*, 95% of the students felt the group peer review process was beneficial and helped them to gain insights into what should be included in a research critique. The most

beneficial aspects were comparing viewpoints, seeing different styles of writing, and clarifying research concepts. Factors mentioned by the students as causing dissatisfaction with the group peer review process were that it was time consuming, they did not like the topics, and they felt it was a lot of work for only five percent of their grade. Students suggested that the groups should be smaller and online drafts and articles should be accessible earlier in the semester. Overall, the students thought that participation in these group peer reviews added to their learning.

Discussion

The group peer review strategy was based on the best practice principles of Gueldenzoph & May (2002). Students participated in a group peer review activity. Topics were based on issues that were of concern to nursing and had been addressed by nurse researchers. Goals were clearly stated and evaluation tools were shared with students, who then evaluated their classmates' work. Formative feedback was given during the collaborative process so that students could incorporate the changes into their final papers (Gueldenzoph & May, 2002; Weimer, 2003). This allowed students to grow in their understanding of the critique process without being penalized. Faculty then provided summative feedback at the conclusion of the process. At the end of the peer activity, students were provided with an opportunity to evaluate their satisfaction with the process and assess individual accountability (Reese-Durham, 2005).

The instructors and students in this course felt that peer review was a valuable learning technique. These findings support those of Reese-Durham (2005), who used peer review in an educational research course. Factors that were detrimental to the process were the preparation time needed for the groups to read the articles and critiques and the extensive time needed to evaluate five critiques in class. Faculty identified another factor: some students had not prepared for the peer review activity by reading the critique drafts and articles that were posted on WebCT. Similar issues have been noted in article discussions regarding active learning strategies (Bonwell & Eison, 1991).

Overall the peer review process was an effective method for encouraging active learning and, through its focus on evaluation, higher levels of thinking on Bloom's taxonomy in the students. They were able to effectively evaluate a peer's critique using the grading rubric. Sometimes students had difficulty identifying whether a peer had met a given criterion or not. This information provided the instructors with knowledge about what to emphasize the next time the course was taught. Since the procedure was done in groups, students learned from each other and developed insights into what they needed to improve upon in their own papers. The instructors frequently overheard students making comments that they now had a better understanding of what was required when conducting a critique after evaluating a classmate's paper. Students in the Reese-Durham (2005) study also indicated a better understanding of how to write a research paper after participating in the peer evaluation process.

Before beginning the critique process, students had to review five articles of varying length and complexity ahead of time in order to assess another group's work. Many students had not prepared by reading the articles and critiques and were not prepared to discuss the other group's work. Because of this dilemma, the faculty recommended that research articles be selected by the instructor and that groups be assigned fewer critiques to review. All the students gave each other high ratings, despite the fact that not all students were prepared. This may be related to the students being unsure of their role as an evaluator and the fact the evaluations were not anonymous. Some evaluator uncertainty was noted in the Reese-Durham (2005) study also, as evidenced by students asking whether they could write comments on the research papers and in cautiousness regarding making comments.

In order to make the process more manageable, it might have been useful to use standardized articles that students could have available to them at the beginning of the semester. Another suggestion might be to have the students develop a critique draft in pairs instead of individually, as this would decrease the preparation time. These measures would cut down on the number of papers to be reviewed during the peer review activity and would also provide them with a collaborative writing project. Another suggestion for change would be to have the students anonymously evaluate their peers' participation in the peer review activity.

There appears to be a limited number of recent research studies in the literature that explore the use of the peer review process in higher education. No research studies were found that explored peer review in a health science course, and only one was found that did so in a research course. The findings from this study provide a unique contribution to the literature because it involves the evaluation of the usefulness of peer review in a research course.

Conclusion

The group peer review active learning strategy was a positive experience for both the students and faculty. This strategy provided students with an opportunity to use higher level thinking skills, work collaboratively, and evaluate scholarly work done by their peers. They had the opportunity to see how other students developed their own critiques and learned from their

mistakes as well as benefited from their accomplishments. As a result, students could use what they learned through the group peer review activity to revise and further develop their own critiques before they submitted them to faculty.

Peer review is a versatile tool that can be used in a variety of academic settings. This evaluation of peer review as an active learning strategy in a nursing research course extends the work in this area to another discipline in higher education. The authors think that peer review will be useful as an active learning strategy in research methods courses in multiple disciplines. It appears to be especially useful in courses where there is an emphasis on developing higher level thinking skills and collaboration. Active learning strategies such as peer review have impacted student success at CSU. Further studies are needed to replicate these findings and explore the usefulness of peer review in a variety of student populations. Peer review has the potential to be an effective method to promote collaborative learning and working among groups. Learning how to think critically and work among groups is a primary role of professionals and is a skill that is needed in the global workforce.

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Appendix A

Grading Rubric for Evaluating Rough Draft of Research Critique

ID Number: _____

Discussion Questions	Yes	No
Did the student discuss the following in their rough draft? **I. Introduction** a. Identify what will be discussed within the critique Comments:		
II. **Substantive & Theoretical** a. Importance for the nursing profession & contributions to nursing knowledge or improving nursing practice b. The "fit", along with rationale, between the research question & the methods used to address the question c. Identify the theory or conceptual model and then briefly describe what this theory means and its relationship to the study Comments:		
III. Methodologic (Quantitative) **a.** Purpose of the study **b.** Type of research design and appropriateness for the study. **c.** Identify the independent and depend variables **d.** Description of the sample. Include accessible and target populations, characteristics of the population to which the findings have been generalized, sample size and how were they recruited, and type of sampling design **e.** Data collection. Include how variables were operationalized, and reliability and validity of instruments **f.** Type of statistical analysis used and appropriateness for answering the research question. Include why or why not you think this test is appropriate. g. Discuss threats to internal and external validity. Include personal opinion of alternative approaches that could be used. **IV. Methodologic (Qualitative)** **a.** Describe the setting and was it appropriate for this type of study. Could another setting have used? **b.** Clearly describe the phenomenon of interest **c.** Describe data collection and appropriateness of this method **d.** Sample description. Include accessible and target population, characteristics of the population to which the findings have been generalized, sample size and recruitment, saturation, and type of sampling design. e. Identify if triangulation was used and discuss f. Discuss types of evidence obtained to support the credibility, transferability, dependability, and confirmability of the data, the analysis, and the interpretation Comments:		

III. Ethical a. Discuss any ethical violations b. Discuss ethical dilemma's impact on the problems regarding scientific merit of the study as well as on the subjects' well-being c. Identify protection of human rights Comments:		
IV. Interpretive a. Discuss important and significant results. Do they agree or disagree with these results? Why or why not? b. Discussion of whether the interpretations of the researcher were consistent with the results. Include limitations of the research. c. Discuss the support or rejection the hypothesis and why or why not d. Discuss generalizations made that are not warranted on the basis of the sample used e. Discussion of implications of the research for nursing practice, nursing theory, or nursing research. Include the appropriateness given the study's limitations? f. Discuss the researcher's recommendations for practice or future studies. Comments:		
V. Presentation & Stylistic a. Discuss adequacy of the study and whether or not there was enough detail to permit a thorough critique b. Identify if report is well written and grammatically correct c. Identify if report is well organized or confusing d. Identify author's overt biases? e. Discuss whether or not the title adequately captures key concepts and the population under investigation Comments:		
VI. Summary a. Compile a brief summary of what has been discussed in this paper b. Discuss personal opinion of what they think about this research article Comments:		
VII. Writing Style Comments:		

Appendix B

NURS 4100 Research Article Critique
Peer Evaluation

Your Group Subject: _____

Assign up to 10 points for each factor by team member, <u>including yourself.</u>

Use the following criterion scale as a guide for your evaluation.

Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree	
1	2	3	4	5	6	7	8	9	10

	Group Members				
Key Behaviors					
1. Came prepared by reading assigned article and reviewing rough draft					
2. Carried fair share of the workload					
3. Was respectful of other ideas and opinions; stayed positive and open-minded					
4. Communicated with the group (gave constructive feedback and input, listened; alerted to problems)					
5. Kept group focused and moving toward goals (e.g., summarized, evaluated, coordinated)					
TOTALS					

Comments:

Appendix C

Evaluation of the
Peer Review Process

1. **Did you feel that the group work was beneficial in developing your critique?**

2. **What was the most beneficial thing that you liked about the group work?**

3. **What was the least beneficial thing that you did not like about the group work?**

4. **What suggestions can you give that would have improved the group process?**

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Scaffolding the Science: Problem Based Strategies for Teaching Interdisciplinary Undergraduate Research Methods

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Previous research has highlighted the effectiveness of Problem-Based Learning (PBL) in multiple disciplinary settings, including medicine, teacher education, business, allied health, and the social sciences. Yet interdisciplinary educators have very little information about how to implement PBL in classrooms where multiple disciplines are represented. This paper offers practical strategies for the successful implementation of PBL in an interdisciplinary context in which learners have a limited knowledge base. In this paper we will a) highlight challenges to interdisciplinary teaching, b) demonstrate how PBL and traditional teaching techniques can be used in an interdisciplinary context, and c) discuss strategies to engage students in making scientific discoveries of their own.

During the past decade there have been a number of case studies that have examined the effectiveness of Problem-Based Learning (PBL) and other curricula that are called inquiry-based, design-based, challenge-based teaching/learning. While there are some variations in these pedagogies, they are increasingly viewed as "close cousins" with many similar, yet discipline-specific, characteristics that focus on learners developing a mastery of the subject matter through direct engagement with real life problems (Barron & Darlington-Hammond, 2008; Savery, 2006). The effectiveness of these teaching strategies has been shown to be valuable in the development of reasoning skills (Hmelo, 1998), problem solving skills (Gallagher, Stepien, & Rosenthal, 1992), self-directed learning (Hmelo & Lin, 2000), and the preparation for future learning (Schwartz & Martin, 2004) across a wide range of disciplines. For instance, specific case studies show success with medical (Hmelo, 1998), educational psychology (Derry, Hmelo-Silver, Nagarajan, Chernobilsky, & Beitzel, 2006), and MBA (Capon & Kuhn, 2004) students.

These and other studies suggest that the direction of scholarship related to PBL should proceed in the direction of practical and effective classroom strategies that facilitate the scientific practices of questioning, investigation, and argumentation. Recent scholarship about PBL has asked for specific practices that effectively provide "optimal scaffolding, coaching, and modeling strategies for successful facilitation of PBL" (Ravitz, 2009; Strobel & van Barneveld, 2009). Our paper answers this call for practical techniques for using PBL strategies in undergraduate classrooms where learners have a very limited knowledge base about scientific research. Moreover, the paper addresses how we used PBL within an interdisciplinary context in which the four instructors were rooted in different natural and social scientific disciplines.

The Course

The impetus for this course emerged from Professor David Lynn and other Emory University faculty who envisioned a program that would provide freshmen an opportunity to learn how scientists in various fields conduct research and then to inspire these students to do research of their own. The goals of the course were to address gaps in college science teaching by emphasizing the practice of scientific research through the use of an interdisciplinary teaching team who would use their ongoing research projects as the basis for the course content (see Leonard 1991; Stukus 1995; Lawson 1999; Tolman 1999; Dimaculangan 2000). The members of the 2006-2007 cohort of instructors included a seemingly dissimilar group of researchers, including a sociologist, an epidemiologist, an economist, and geneticist (Table 1). The instructors aimed to develop a research methods course that would maintain the integrity of each of their disciplines while simultaneously bridging their diverse research endeavors through the commonalities of scientific inquiry. In this process, we used our own projects to demonstrate practical research while simultaneously allowing students to engage in increasingly complex, problem based research tasks throughout the semester. Through these sequential and cumulative tasks, as well as the necessary supports of instructors who provided modeling, coaching, task structuring, and relevant feedback or engaged questions, students became increasingly accomplished problem solvers and budding researchers. In short, using PBL allowed our interdisciplinary team to bridge our differences and to inspire students to engage in scientific research of their own.

Each instructor had four weeks to teach his/her individual module, in which she/he aimed to convey the essence of how an interest evolves into a research

Table 1
ORDER 2006-2007 Instructors and Modules

Instructor	Discipline	Module Title
Heather Jamerson	Sociologist	Globalizing the Economy: Mapping Production and Consumption
Lyndsey Darrow	Epidemiologist	Air Pollution and Health In Atlanta
David Tan	Economist	The Economic Sociology of Emerging Technologies
Alaine Keebaugh	Geneticist	Human Genome Project: The Technology, the Controversy and Our Future

question and the methods best suited to answer that question. The overarching goals for the course were that students would have a better sense of each individual discipline, see the role of science as unifying divergent scientific disciplines, and understand how to formulate their own research question and most appropriate methods for investigating it. To achieve these goals, the course was also designed to incorporate PBL, whereby the students learn through demonstration (examples) and discovery/exploration, as well as active learning including readings from primary literature, mini-lectures, movie nights, debates, experiments, and computer labs. At the end of the course, each student developed, wrote and shared their work in a final presentation.

One of the unique characteristics about our teaching team is that we share very little overlap in our research interests and agendas. More specifically, we are not interdisciplinary scholars studying a common topic like “water” or “poverty” or “disease.” Instead, our areas of research diverge in almost every imaginable direction—including our topics of inquiry and our chosen research methods. For instance, Darrow’s research investigates the effect of air pollution in Atlanta on infant mortality and pre-term birth by using an observational research design. Tan’s research uses economic modeling to understand how existing patent classifications can restrict technological innovation. Keebaugh’s research uses the information generated from multiple genome sequencing endeavors to explore how gene duplication has contributed to species differences and human disease. Lastly, Jamerson’s research seeks to understand the mutually constitutive processes of production and consumption within an increasingly globalized society by using a multi-site case study and qualitative methods. From these brief descriptions, one can easily see that we share very little in terms of substantive connections or methodological similarities.

In order to bridge these differences and to provide a scaffold for the course, the instructors met approximately every two weeks during the summer prior to our first semester teaching the course. In this planning stage, each of us were charged with the task of explaining our own research projects to colleagues who did not share a common language, theoretical framework, or disciplinary understanding. However, discussing our own research and our own disciplines was essential to developing a unified framework for the course and deciding how to convey our particular research projects without using the language specialized to our discipline. To discover these connections we needed to know something about the others’ disciplines and research. Hence, we spent many of our early meetings trying to locate commonalities and differences in our levels of analysis, research methods, scientific vocabularies, and theories.

Challenges and Successes of Interdisciplinary Teaching

Developing a Meta-language

One of the major challenges of interdisciplinary teaching begins with the fact that each instructor is trained in only one discipline. Therefore, we were immediately faced with the question, "How can we integrate our disciplinary differences into a coherent course?” Over several meetings, we stopped trying to decipher the discipline-specific language in favor of a shared terminology that emphasized commonalities such as independent and dependent variables, unobserved and observed processes, inference and hypothesis testing. In a sense we began to recognize a meta-language – about the scientific process – through which we could communicate about each other’s research. This allowed us to construct a course that was integrated by the underlying unity of science that is evident in each of our natural or social scientific disciplines. Take for example, how each of our disciplines maps causal relationships. Epidemiologists use directed acyclic graphs to represent hypotheses about the relationships between variables while economists use comparative static models. Similarly, geneticists use phylogenetic trees to illustrate relationships between genes or species while sociologists might use a theoretical diagram to visually represent causal processes. In the early stages of our planning the specificity of our disciplinary language (e.g., acyclic graph, comparative static models, etc.) masked the more general commonalities among our research processes. However, once we were able to agree upon an overarching methodological terminology

the focus of the course became much easier to envision. With this awareness, we decided not to offer the students a mini-session in genomics, epidemiology, sociology, or economics. If we had taken this approach, then our students would have ended up with independent unrelated modules, which would have been essentially crash courses in each of our separate disciplines. Instead, we decided to use our disciplinary differences as our greatest strength—whereby students would be offered a spectrum of disciplinary interests and methodological approaches to ignite their own interests in scientific research. To do this we decided to use a combination of traditional instruction that would provide basic content for freshmen learners and PBL strategies that would offer students the opportunity to develop critical thinking and reasoning skills needed to propose their own research projects.

Implementing PBL in an Interdisciplinary Setting

Minimally structured, exploratory learning (a PBL-like strategy) is appropriate for learners already familiar with a given content area; however, for learners who are novices in a content area, learner guidance is essential. Using the common language of scientific research we sought to create a sense of continuity between the four very distinct modules by first introducing the different disciplines using a "delayed teaching" approach in which we first create a need for, and interest, in information before it is presented. Specifically, we used our own research projects to stimulate interest in a topic and then that used traditional teaching methods, e.g., lectures, to establish a general knowledge base. This approach paved the way for more exploratory, self-guided instruction later in the module (Mergendoller, Maxwell, & Bellisimo, 2006). Furthermore, because PBL inherently positions learning in complex tasks, various scaffolding strategies (e.g., delayed teaching) were often embedded within activities to help students engage in the problem solving processes, articulate their thinking, and reflect on their learning (Quintana et al., 2004). To maintain a sense of continuity, each module contained (a) a similar structure, (b) content overlap, and (c) instructor-student mentoring.

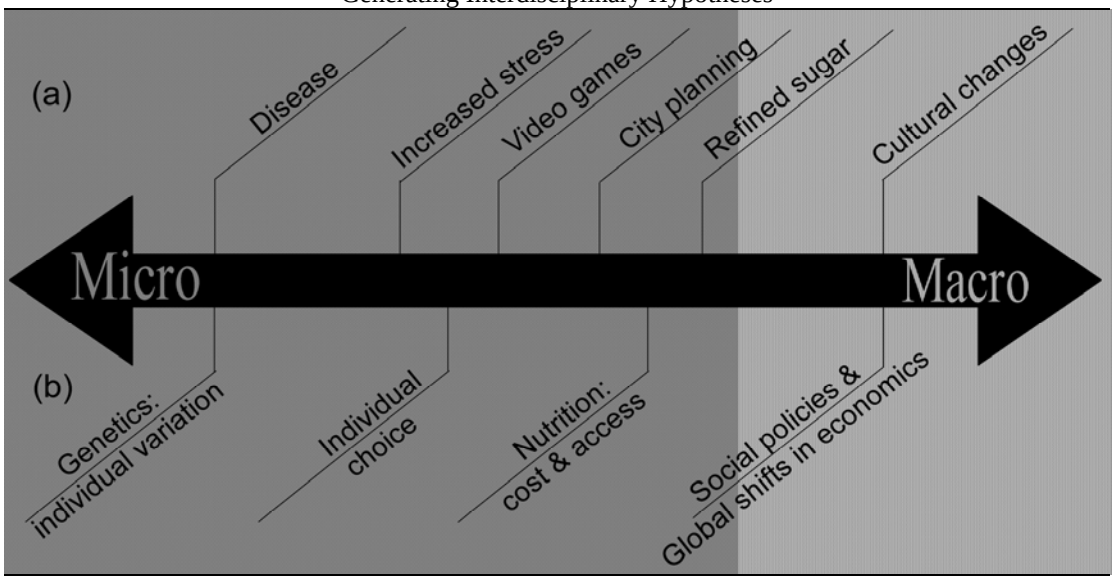
Similar structure for each module. First, by maintaining a similar structure – through a progression from more traditional teaching methods to more sophisticated PBL strategies throughout the semester – for each of the modules we were able to create a sense of continuity between the four very distinct modules. First, each of the four modules started with a basic background of our disciplines, especially given that many freshmen may have never even heard of our field of research. Again, the focus provided less of a crash course in the discipline, but rather it introduced students to the type of research being undertaken in our respective fields. Therefore, in each module students worked in groups with primary research articles to identify important aspects of the study, such as locating the hypothesis, identifying how variables were measured, understanding the control variables, and determining whether the hypothesis was supported by the data. Care was taken to choose an article that would be manageable to freshman. Additionally, the students presented this information to their peers, giving them a chance to clearly explain the research methods being used in the study. Not only did this exercise introduce students to our disciplines, but it also gave them a chance to read research articles and identify various aspects of a research design, and it provided good practice for the end of the semester when they presented their own project proposals.

Second, each instructor used his or her own research to illustrate some aspect of the research process. For instance, during the first module, Jamerson used her own research to introduce the process of transforming broad research interests into a scientific research question and generating a testable hypothesis. Darrow then discussed the relationship between variables and issues related to measurement using epidemiological research. In Tan's economic module, he demonstrated the use of theory in research by illustrating inference, observable and unobservable variables, and measures. In the last module, Keebaugh used her research to demonstrate how to access genomic sequence databases and how to use the data to accept or reject hypotheses. By the end of the semester, students not only understood the continuity of the scientific process, but they could also identify variations among projects, such as why one researcher might use qualitative methods to answer one research question, while other researchers might use quantitative methods to answer different research questions (See Figure 1).

Third, each module culminated in a class debate or discussion where students could apply what they had learned in the module and make arguments related to ethical issues surrounding our research. The debate topics highlighted how the results of our research could either inform public policy and/or influence human behavior in some way. Not only did this provide continuity across modules, but it also helped students grasp the everyday significance of scientific research in politics, labor markets, medicine, or business innovation.

Content overlap. The most obvious example of content overlap was the fact that the instructors provided a repeated focus on scientific research methods and their relevance for answering questions

Figure 1
Generating Interdisciplinary Hypotheses



Note. Student generated (a) and teacher-scholar generated (b) hypotheses for "What is causing the rise in obesity in the United States?" Hypotheses ranged from the microscopic level of heritability to the macro level of globalization, helping students appreciate that how we recognize a problem will have an impact on how we choose to study the problem—in terms of our level of analysis, our hypotheses, and the methods we choose to use.

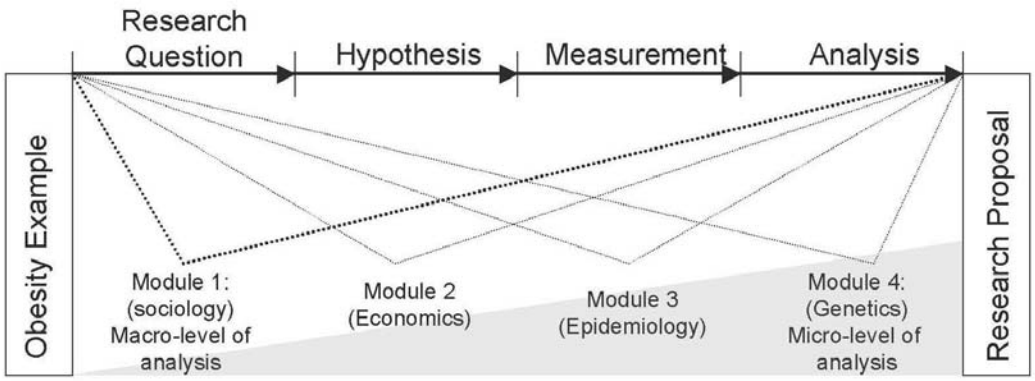
connected with real-life events. As discussed above, one of the primary goals of the course was for students to recognize continuity across various scientific disciplines. Therefore, we each prepared modules that would invoke questions from students about our topic of inquiry. In other words, the instructors engaged students in discussions that would stimulate their own questions and then walked them through the various stages of research that could lead to an answer. Throughout the semester, the level of sophistication of these research designs improved dramatically as students understood the how to generate a testable hypothesis, define variables, consider sampling parameters and discuss measurement issues. Again, we began with traditional instruction, and then PBL strategies facilitated more advanced self-guided learning by providing a foundation of knowledge.

While the course was intended to teach research methods, an underlying objective was to generate student interest in conducting their own scientific research. To do this, we wanted to take advantage of our strengths as a broadly trained teaching team. From early in our planning meetings, one of our strengths became very clear—namely the breadth of knowledge that we all brought to the classroom. For instance, rarely were we able to discuss a topic within popular culture about which we did not have differing knowledge, interests, or interpretations. In most cases our differences were due to the varied levels of analysis on which our disciplines focus. This awareness provided us a springboard from which we could structure the semester. Therefore, the order of our teaching modules was structured from the macro level of analysis (e.g., globalization) at the beginning of the semester to the micro level of analysis (e.g., genetics) at the end. Darrow's research at the population level and Tan's research at the individual level fit nicely in the middle of these two poles.

Research Questions

We wanted students to understand that each of our disciplines might use science to study similar issues differently. Thus we began the course with exercises that are often used in sociology. Employing the formative article, "The Sociological Imagination" written by C. Wright Mill, students were asked to consider a social problem and its causes, ranging from "private troubles" – individual level explanations – to "social problems" – structural level explanations (Mills, 1959). As one example, students were asked to break into small groups and brainstorm about the causes for rising rates of obesity in the United States. This topic made for a great introductory example, not only because of its popularity within the news and popular press, but also because research shows that college age students are concerned with issues related to body image (Striegel-Moore, 1989). Moreover, there are major health consequences associated with obesity – e.g., diabetes, heart disease, strokes, and certain kinds

Figure 2
Scaffolding for Teaching Research Methods



Note. The course was organized into four different disciplinary modules, each focusing on how to approach a real life question (such as the rising rates of obesity) using the scientific method; the modules were organized so that each module was directed at different a level of analysis with the cumulative goal that students would develop the skills needed to ask and answer their own unique questions in the form of a research proposal. To accomplish this goal each module went through the scientific process using discipline-specific theory and expertise. This type of scaffolding provided an environment that allowed the students to engage in this complex task, which would have otherwise been beyond their current abilities.

of cancer – all of which have individual as well as social effects (Brownell 2004). Significantly, obesity in the United States (and other industrialized countries) is on the rise. The Centers for Disease Control found that during the 1970s the obesity rate for adults ages 20-74 years of age in the U.S. was 15%. By 2004 that percentage had jumped to 34% while the rate tripled in children during those same years (www.cdc.gov/nccdphp/dnpa/obesity/index.htm).

Explaining to students that these trends are empirical findings, they were asked, "What is causing the rise in obesity in the United States?" Students came up with many hypotheses that ranged from the microscopic level of heritability to the macro level of the globalization of food systems. In class, we placed these explanations on a visual continuum, showing that this problem spans many levels of analysis (see Figure 2). Once the students had offered their ideas, each of the instructors discussed how his/her discipline might begin to explain and research the problem of obesity. The breadth of our interests and knowledge ranges from the microscopic level of DNA all the way up to global value chains. Thus, in the case of rising obesity rates, each of us in our disciplines ask different questions directed toward different levels of analysis. For instance, a sociologist might ask, "How do state level policies affect the production of particular products (e.g., corn) that contribute to obesity?"; however, an epidemiologist might question the effects of hormonally active compounds (e.g., in meats) on weight gain (i.e., obesity). In a similar way, an economist might focus her/his research on the incentives that influence individual level choices about food, and a geneticist might examine genetic novelties that could cause rising rates of obesity.

Equal in importance to the research questions are the methods we might use to explore our question and hypotheses. In this example, a sociologist might focus on the patterns of subsidies to U.S. corn farmers and determine the major actors who initiate these policies: were they special interest groups, lobbyists, coalitions, politicians, corporations, etc.? To explore the question whose interests are being served by subsidies to corn farmers, the research methods might include tracing historical patterns in subsidies – money spent by state and federal agencies – to corn producers and rising rates of obesity to see if there is a correlation between these variables. Alternatively, an epidemiologist might investigate whether or not the growth hormones injected into livestock – hormones that end up in our dairy and meat products – effect obesity rates. To examine this, one could compare a sample of obese individuals to a group of individuals from the same population who are in the healthy BMI weight range. Methods might include measuring dietary intake and collecting blood samples to directly measure biomarkers of exposure to hormonally active compounds. One could then compare the obese group to those who are within the healthy BMI range to see if the obese group was exposed to more growth hormone

than the non-obese group (while controlling for a variety of other factors). This example helped students to appreciate that the way we recognize the problem will have an impact on how we choose to study the problem, in terms of our level of analysis, our hypotheses, and the methods we choose to use. Using this exercise early in the semester allowed us the opportunity to introduce problem-based learning, whereby students were given a problem that stimulates multiple theoretical explanations and methods of investigation. Therefore, this exercise set the precedent for the course, whereby the students were inspired to identify a problem in their lives and develop a research project of their own.

A Real-Life Example

We also used films and other content to provide concrete real life connections across modules. For instance, we showed the movie *Made In China* during the first module on globalization and then revisited the film's content in subsequent modules. This film follows the life-cycle of plastic Mardi Gras beads from their production in a small factory in China to their consumption at Mardi Gras in New Orleans. In the class following the film, students were asked to map the commodity chain starting with the production of beads in China and ending in their consumption in the U.S. The film also offers an opportunity to discuss the rewards and risks along the value chain – e.g., where are wages the highest, where are the biggest risks to the environment or to human health – as well as the culture and structure of consumption in the United States. Not only does the film provide a source for conversation about globalization, but it also humanizes the people associated with the beads, from workers in China to revelers in New Orleans, and it shows how ordinary people are connected to each other through beads exchanged during Mardi Gras. This allowed for a more personal discussion about abstract and distant processes such as globalization, production, and consumption. In the next module, Darrow used the film to discuss the pollution associated with the transportation of the beads from China to the U.S. and the health consequences of polyvinyl chloride (PVC) on human health and the environment. Again, this strategy emphasizes our focus on problem-based learning, since PVC is the most popular plastic used in the United States despite the fact that it has been linked to numerous public health risks such as cancer, birth defects, genetic changes, chronic bronchitis, ulcers, skin diseases, deafness, vision failure, indigestion, and liver dysfunction (www.ecologycenter.org). In the third module, Tan used the film to illustrate economic modeling by creating predictions about the effect of increasing wages to factory workers in China on the production output of the beads. The film provided real-life characters and concrete examples of abstract theory and mathematical modeling that can often be difficult for freshman students. Finally, Keebaugh used the film to discuss the carcinogenic effects of the plastics as an example of tracing genetic mutations in a phylogenetic context. Then, phylogenies were then used to illustrate how the emergence of genetic mutations can be identified and dated in a population.

Given the brevity of each instructional module (five class days), using content presented in previous modules proved to be indispensable for the instructors. For example, Tan used the example of the disparity in lifestyles between the factory owner and factory workers to examine the effects of increased wages on bead production. The students were already connected to the characters, and thus Tan was able to effectively illustrate economic modeling in one class period. Without the movie and previous discussion about the film, Tan would have had to spend precious time setting up the relevance and context and then communicating the content of modeling.

Final Project

The final project was the unifying scaffold that pushed students to articulate their thinking, identify the limits of their knowledge, and design a research plan to expand their knowledge. One of the most challenging and rewarding portions of the course involved the final project, in which the students developed their own research proposal on a topic of interest to them. The written proposal and the class presentation made up over 50 percent of each student's grade for the course, so we began working on the project during the first week of the semester and continued to build upon it throughout all of the modules. The overall purpose of this project was twofold. First, we wanted to evoke a sense of curiosity, creativity, and critical thinking that are the essence of valuable research. Second, we sought to empower students with the skills, knowledge, and confidence necessary to embark upon scientific research on their own. The assignment included all of the major sections found in scientific proposals, including a clearly stated research question, defined independent and dependent variables, a literature review that included at least five scholarly citations, a testable hypothesis, sampling criteria, methods for data collection, controls, and a brief section on contributions to the scientific community and society as a whole (we omitted the requirement for specific types of analysis).

The topics of inquiry needed to have some relevance to the students so that they would have an intrinsic motivation to stay engaged with the project. For instance, the instructors encouraged students to identify a problem that they faced in their everyday

lives at Emory, such as racial segregation on campus, increased risk of STD's among college students, alcohol consumption within fraternities, and the dangers of weight loss supplements. By exploring their own real-world problem, students were given ownership of the learning process and thus were motivated to engage in a research process that would provide them answers (Savery, 1995). After students were given ownership of their question, our goal was to provide them the "instructional scaffolding" necessary to succeed (Chin, 2006; Guzdial, 1994; Linn, Davis, & Bell, 2004; Reiser et al., 2001). Therefore, we offered them a range of structure and tools to support the development of problem solving skills, including structured deadlines, collaborative workshops and mentoring.

Aspects of Support

First, the syllabus outlined dates when various sections of the project were due, and these dates corresponded with the information covered in each of the modules. For instance, during the first module students were introduced to the process of transforming a broad research interest into a feasible research question. This instruction corresponded with assignments to brainstorm about their interests, to narrow their interests down to one area of focus, and then to develop a research question that included a clear dependent and independent variable. Similarly, other assignments related to their project were due immediately following methods instruction contained in each of the modules.

Second, throughout the semester we scheduled "workshop" days that complemented their research project development. For example, early in the semester the instructors coordinated with the Emory library staff to assist students in using library and web-based resources to look up scientific articles to use in their literature review. Next, we scheduled a day when students were divided into small groups in which they presented drafts of their research designs to an instructor and several peers. These sessions were invaluable as students got feedback on various aspects of their design while they also offered their insight to others working through similar research-related issues. This technique also corresponds with the collaborative nature of the sciences and the necessity of peer review and the exchange of new ideas from across disciplines.

Third, an instructor was randomly assigned to mentor each student throughout the course of the semester. While each student was required to meet with his/her mentor at least once, most students met with their mentor many times to gain assistance throughout the process of developing their research question and design. The assignment of mentors to students allowed for the easy transition from teacher as expert to facilitator of learning (Ertmer 2006). Not surprisingly, students had a difficult time narrowing down their question to a testable hypothesis and then identifying the appropriate methods to explore it, so one-on-one mentoring helped students work through these difficulties. Again, one of our greatest strengths as a teaching team was our divergent interests, skills, and experience conducting research of our own. Therefore, even though we were randomly assigned students before they decided on their research interests, we were able to gain assistance from other instructors for particular issues related to student topics. For instance, when a student wanted to research social scientific questions on religion, politics, race relations, etc., the student could get assistance from the social scientists as well as his/her mentor in the natural sciences, and vice versa. As mentors we also guided students to appropriate graduate students, postdoctoral fellows, and Emory faculty members in a variety of disciplines who facilitated further development of their theories and research methods; this also gave them experience communicating with other researchers about science and the process of their own discoveries.

Conclusion

Interdisciplinary teaching poses a unique set of problems for educators. Not only do we have to learn how to speak more clearly to each other as scholars, we also have to develop a coherent set of ideas and teaching strategies to facilitate communication with undergraduate students who have very little understanding of the disciplinary divides that can confine us as teachers and researchers. While this certainly can present challenges, it also opens up a range of intellectual and pedagogical possibilities not available to us when we remain within our discipline-specific categories of knowledge and interactions. Our teaching team was able to offer a course that exposed undergraduate students to four different scientific disciplines, introduced basic research methods and design, inspired students to ask questions about their everyday world, and provided the skills for them to develop a research proposal of their own. The seminar was successful in engaging students in the process of scientific discovery, as evidenced by their final research proposal and their own initiative to undertake their research projects beyond the semester's end. Several students have joined the staff of the *Emory Undergraduate Research Journal*, which offers a forum for undergraduate researchers to publish their findings for the larger Emory community (www.eurj.com)

A key aspect in the successful implementation of our course was using a combination of instructional strategies. Employing the key pedagogies of both traditional and PBL instruction was significant in that it

allowed students to develop a knowledge base that spanned disciplinary boundaries and was sufficient to foster self-directed inquiry. Furthermore, it allowed us, the instructors, to capitalize upon the theoretical and methodological strengths of our disciplinary differences while also engaging students in real-life issues. We also found that the incorporation of scaffolding strategies (e.g., debate/discussion, mentoring, and mini-lectures) was essential in that it reduced the initial cognitive load on the students, allowing them to engage in more complex tasks that would have otherwise been beyond their current abilities.

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Critical Reading: Using Reading Prompts to Promote Active Engagement with Text

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The assignment of pre-class reading is a common practice in higher education. Typically, the purpose of this reading assignment is to expose students to background knowledge that will be useful in an upcoming class discussion or to introduce a topic that will be presented more directly by the instructor. However, numbers of undergraduates actually completing these assignments are very low (Ruscio, 2001). The purpose of this article is to describe a variety of reading/writing prompts that can be used to promote critical out-of-class reading by undergraduate students. Critical reading involves the art and science of analyzing and evaluating text while maintaining a view towards improving the nature of thought and one's subsequent actions (Paul & Elder, 2008). The prompts are organized into six categories: (1) identification of problem or issue, (2) making connections, (3) interpretation of evidence, (4) challenging assumptions, (5) making applications, and (6) taking a different point-of-view. The specific context of how to use and assign these reading/writing prompts and the subsequent benefits from their use will also be discussed.

Instructors ask students to read a variety of materials outside of the class session: textbooks, primary documents, newspapers, magazines, academic journals, or on-line materials. As I make weekly out-of-class reading assignments, I recall those many undergraduate classes that I took in college in which the professor assigned weekly readings, and for the most part, I barely skimmed the text. After all, I thought, the professor was going to deliver the most important course content during the next class lecture anyway. Reading the text was time consuming and often intellectually labor intensive, and besides, my professor was going to *tell* me what was on the next exam plus give me a study guide, so why bother with the reading? I figured, "Why not skip the reading and just take good notes during class?" Sometimes, instructors provoke this limited attention to out-of-class reading because they do not attend to or reference the reading during class time. Students may then be of the opinion that out-of-class reading assignments have no real connection to class activities. Now that I assign reading to students myself, I had to ask, what can I do to help my students see the value in carefully and critically reading out-of-class assignments? The purpose of this article is to highlight reading/writing prompts that I have used to promote out-of-class critical reading by my elementary education methods students. These reading/writing prompts will be significant across disciplinary boundaries.

Readers comprehend the printed text by retrieving from their memory prior experiences and concepts that are rooted in the reader's culture (Applegate, Quinn, & Applegate, 2002). Good readers connect their past experiences with the text: interpreting, evaluating, and considering alternative responses or interpretations. Critical reading is the art of analyzing and evaluating text and thinking with a view to improving the nature of thought (Paul & Elder, 2008). Students can critically read in a variety of ways:

- When they raise vital questions and problems from the text,
- When they gather and assess relevant information and then offer plausible interpretations of that information,
- When they test their interpretations against previous knowledge or experience and current experience,
- When they examine their assumptions and the implications of those assumptions, and
- When they use what they have read to communicate effectively with others or to develop potential solutions to complex problems.

McDonald (2004) defines critical reading as an alternative way of reading that goes beyond the "typical approaches to reading such as information processing or personal response" (p. 18). An example of an information processing approach to reading might be when students outline or summarize the main ideas in the text. An example of a personal response approach might be when students are asked to describe their feelings or impressions related to a selection of text.

Critical reading aligns with reader response learning theories. Based on this theoretical model, students do not try to figure out an author's meaning as they read. Instead, the reader negotiates or creates meaning that makes sense based on personal background knowledge (Tompkins, 2006). Rosenblatt (1991) suggests a continuum of stance or purpose for reading. On the one end is the aesthetic stance where reading is done for enjoyment or pleasure. On the other is the efferent stance in which the purpose of reading is

to locate and remember information. Reader response learning theories suggest that students often use a combination of the two stances when they read. For example, when undergraduate students read the memoir of Esme Raji Codell, *Educating Esme: Diary of a Teacher's First Year* (Codell, 1999), they may read efferently to locate information about specific teaching practices, and they may read aesthetically as they ponder the complex dynamics of the fifth grade classroom and the urban public school setting in general.

Students can apply reader response theory when they respond to literature by writing and participating in instructional conversations (Tompkins, 2006). To promote this type of critical reader response by undergraduate students, I have gathered a variety of reading/writing prompts to dovetail with out-of-class reading assignments. The purpose of these reading/writing prompts is to facilitate personal connection between the undergraduate student and the assigned text. The prompts are simply questions used to orient students with a critical reading stance and to guide their thinking as they read.

The purpose of the prompt is not to help students to acquire information for course assessment purposes or to simply complete a class assignment. For example, some traditional reading tasks might be taking two-column notes, summarizing the text, outlining the key points of the text, or taking comprehension quizzes. The overarching goal of the prompts presented in this article is to help undergraduate students to be able to synthesize and respond to the big ideas from the reading selection as opposed to mining facts or details. That is not to say that there are times when mining important facts is not important; however, I find that undergraduate students have some success with identifying facts from reading and less success with focusing on the big ideas or thinking about the content with a critical or personal mindset.

Choosing a significant and realistic purpose for the reading assignment is vital to presenting prompts that will promote critical reading. The value in realistic responses is that students have the opportunity to do something with what they are learning through their reading (Meyers & Jones, 1993). Realistic responses to questions are more like the way students will think and act in the world outside of the academic classroom. For example, instead of identifying the vital components of differentiated instruction, students may be asked to write a description of differentiated instruction for parents of children in their future classroom.

Instructional choices are guided by an instructors' values and assumptions related to teaching and learning. The assumptions behind the development of these reading/writing prompts is that learning is an active process and the learners must take up knowledge and make it their own. Active learning, as described by Meyers and Jones (1993), involves providing opportunities for students to "meaningfully talk and listen, write, read and reflect on the content, ideas, issues and concerns of an academic subject"(p. 6). The instructors' role is to guide the active learning process in a variety of ways, one way being the use of reading/writing prompts to promote critical reading. Through class discussions or peer responses, students additionally have the opportunity to engage in meaningful listening and talk. Use of these reading/writing prompts creates a more active and dynamic learning experience for undergraduate students.

Critical Reading/Writing Prompts

The nature of each reading/writing prompt targets a specific critical thinking skill. The variety of prompts suggested in this article requires a range of critical thinking responses from students. Although the prompts are categorized, they do not reflect a linear or hierarchical view of the upper levels of cognitive taxonomy (application, analysis, synthesis, evaluation). Therefore, there is no suggested linear fashion with which to introduce the prompts. The variety of critical responses called for by these prompts suggests an interactive approach to the development of critical thinking instead of a hierarchal approach (Orlich, 1991).

The critical reading/writing prompts elicit a reader response that promotes the alignment of readers with the literary text in a variety of different ways. Most of the following prompts are written in the first person to promote active and personal learning. The prompts are organized into six categories: (1) identification of problem or issue, (2) making connections, (3) interpretation of evidence, (4) challenging assumptions, (5) making applications, and (6) taking a different point-of-view. Students are expected to read with the cognitive framework implied in the question and respond in a written format. The task of responding to these prompts in a written format helps students explore their own thinking about concepts or issues in a manner that helps them to expand, clarify, or modify their existing mental structures (Meyers & Jones, 1993).

Identification of Problem or Issue

Students are asked to identify and describe the potential purpose for why the reading selection was written. This lens may create a 'need to know' viewpoint for students as they read.

- What problem is the author identifying? Who does the problem relate to?
- What are the complexities of this issue?
- For whom is this topic important and why?

Making Connections

Students have the opportunity to think critically about course topics when instructors help them to make connections between what they are reading and their existing cultural knowledge. The subjectivity of the reader can be examined, clarified, and melded with the text when the personal experiences of the reader are integrated with the experiences or circumstances in the text (McDonald, 2004).

- What do I already know about this topic? Where and how have I acquired this knowledge? What might be the limitations of my thinking related to this topic?
- How is what I am reading different from what I already know? Why might this difference exist?
- What new ideas are here for me to consider? Why am I willing to consider them? Why am I not willing to consider them?
- What experiences have I had in my internship that support, confound, or refute the information presented from this reading assignment?
- What information from this reading selection resonates with, and contributes to, my interest in teaching and learning?
- How do the principles from this reading selection compare to what I am learning in my other courses?
- What connections can I make between this reading selection and something else that we have discussed in this course?
- Make a list of presented ideas that are similar to your own and a separate list of ideas you have not thought about before.

Interpretation of Evidence

This type of prompt is most often used when reading case studies, viewing video clips, or reviewing student work samples. When students come to the next class session, inferences are checked for consistency with other students, identifying biases and assumptions that may have affected and shaped differing inferences.

- What inferences can I make from the evidence given in the reading selection?
- What patterns of student activity do I notice? What inferences can I draw related to student engagement and student learning?
- What patterns of teacher activity do I notice? How are students responding to these patterns of activities?
- What learning strategies do I see teachers promoting or the children using?
- What relevant evidence or examples does the author give to support his or her justification of a particular teaching technique? Am I convinced this teaching approach will be successful in my internship classroom? Why or why not?
- How does this author acknowledge the complexities of the classroom?

Challenging Assumptions

Students are to clearly identify and critique their potentially seldom-tested assumptions, determine the source of their assumptions, and evaluate their validity based on the evidence given. Students are also asked to consider the assumptions made by the author. As students take up different stances, they learn to recognize how perspective might mask or expose the assumptions that influence reading (Pace, 2006).

- This chapter/article is about assertive discipline (insert any topic here). What assumptions do I have about assertive discipline? How have my assumptions shaped my initial point-of-view? What information from the reading opposes my assumptions? What information from the reading supports my assumption?
- What do I still not know or understand about this topic? (Post-reading prompt)
- In what areas has this reading helped me to discover a potential need for change in my approach to teaching?
- What kind of assumptions is the author making? Do I share these same assumptions?
- What does the author appear to value? Have I been convinced to value these same things? Why or why not?
- What information builds my confidence in the authors' expertise?
- If the opportunity arose, what questions would I pose to the author?
- How does my frame-of-reference affect my understanding and interpretation of this information?
- Write your mathematics learning autobiography (or any other subject). What

emotions, feelings, and/or assumptions related to learning are you bring to this discussion?

Making Application

These reading prompts help students to use what they have learned through their reading in very practical ways. These realistic response opportunities may help students to see more value in the reading assignment.

- What advice could I add to this reading selection? On what basis do I give this advice?
- 3-2-1 reading application. What are three of the most important concepts from this reading? What two pieces of information would I share with a colleague (a colleague would be someone you might work with during your first year of employment)? What is one way I will alter my current teaching practice based on what I have read?
- How did this reading help me to build my professional knowledge (or skill)?
- In what ways did this reading selection prompt me to pay attention to something different in the teaching and learning environment than what I have noticed before?
- In what ways has this reading selection helped me to understand myself better as a developing teacher professional?
- Looking back over my internship teaching experiences thus far, what suggestions from the reading make the most sense to me?
- Looking towards where I want to be in two years, what suggestions from the reading make the most sense to me?

Taking a Different Point of View

Informally writing for someone who presumably knows little about a topic typically allows student to think in a less formal, conversational manner that may be more effective in helping them to make meaning of the text (Meyers & Jones, 1993). Providing opportunities for students to consider diverse ideas supports critical reading (Fecho, 2001).

- Write an explanation of a topic for a parent. [For example, if the topic was differentiated instruction the reading/writing prompt might be, "Using only three sentences, how would I describe differentiated instruction to a parent? The explanation should include the key concepts of differentiation but be in a language that a non-educator could understand."]
- Meeting opposition. What would I point out as important about this topic to others who either question or disagree with my point of view? [For example, if the topic was differentiated instruction the reading/writing prompt might be, "Differentiated instruction is just a sneaky method for tracking students. Defend your position that this statement is false, OR defend your position that this statement is true. Use evidence from your readings."]

Assigning the Reading/Writing Prompts

The reading/writing prompt is assigned at the same time that a reading assignment is given (usually at the end of the class period). There is only one prompt per reading assignment. Students are to complete the reading and answer the prompt before the next class period. Student responses are typically one or two paragraphs. Depending on the length of the reading assignment and the class schedule, students may have one night or one week to respond to the reading.

Students are asked to respond to the prompts in a variety of ways depending on the type or length of the response. They might post their reading response on a Blackboard discussion board (usually for shorter responses). Students may be required to read the responses made by other members of the class and, sometimes, make comments on peer responses before coming to class. Typically, I do not intervene in these Blackboard discussions. At other times, I collect the responses on Blackboard to shape my introduction to the next class session. The student responses give me an indication of how students are processing their reading and what confusions or misconceptions might be emerging.

On occasion, I ask a student to email his or her response to another student in the class. The student pair is required to respond to each other's response simply by asking clarifying questions. Upon arriving to class, I begin by having two student pairs (4 students) engage in an initial discussion of the topic under review for that class period. Creating a situation where an exchange of ideas is student-to-student instead of student-to-teacher usually results in thinking that is clearer and less pretentious (Fulwiler, 1987). In other words, students are less interested in impressing the instructor with their knowledge and more interested in communicating understanding.

For some reading prompts, I have students simply word-process their response and bring them to the next class session. The emphasis for method of response needs to be on variety. Give students many different ways to respond and to talk about or share their

responses with peers and with the instructor. This variety helps to keep the reading/writing responses from becoming stale and routine.

The manner in which an instructor will build on the pre-class reading prompts depends on the nature of the text and the type of reading prompt used. However, in most cases, the reading prompts described in this article prompt students to make personal connections with the text. These personal connections help students to find more meaning and relevance with the text. Initial class discussions begin with these personal connection points. Important content from the reading is always explicitly identified, as is application of the content in new situations. Because students have thought more deeply about the pre-class reading, I anecdotally have found they are more engaged and thoughtful during in-class discussions and can apply their new learning in different contexts more successfully. Sometimes the discussions are brief and only serve to focus the subsequent lesson. At other times the conversations are much longer and become a framework for presenting the content for the day's lesson.

Students are instructed to not worry about grammar, punctuation, or paragraph structure in their written responses. This is not a writing assignment, but the emphasis is made on uncovering meaning, application, or perspective of the text. Responses are not formally graded, but the syllabus makes it clear that the instructor keeps track of the extent to which the responses indicate that the student has done the readings and thought about them. Depending on class size, the amount of time to read and respond to these papers may be problematic. In most cases I indicate that I have read the response with a checkmark. My feedback is usually short and positive with comments such as "interesting idea" or "great connection." Sometimes I will notate that a comment is particularly profound and ask that the student share his or her written response during our class discussion. However, when students have particular difficulties, ask specific questions, or offer unusually insightful observations, I do offer more specific and extensive feedback.

Benefits of Using Prompts

A serendipitous by-product of using these reading/writing prompts has been richer class discussions. I have found that more personal responses are shared, more connections are made between internship experiences and course content, more active interchanges are made among students, and students are generally more engaged in the class discussions by asking clarifying questions. August (2000) suggests that writing associated with out-of-class reading improves student preparation.

An additional benefit was that reading the responses before the class session helped me to be better prepared to more purposefully shape and guide the discussion, activity, or content delivery portion of the subsequent class. The responses were frequently collected from the Blackboard site and used as a springboard for the next class discussion. Common ideas, emerging thoughts, or possible misconceptions represented in the responses were typically the focus of these early class discussions. Reading these responses before class helped me to focus the beginning of class discussion and make important connections between the out-of-class reading and the topic of the current class session. For example, reading response postings before class helped me to identify single viewpoints that are often characteristic of undergraduate students. This allowed me to help students recognize their own biases and to begin to consider alternative perspectives on a subject. A future area of research may be an attempt to contextually describe this type of richer student engagement during class discussions.

Additionally, this type of reading prompt/writing response ensures that all students will have the opportunity to engage in a type of intellectual discussion. Depending on the size of the class, it may be difficult to engage all of the students in an in-class discussion. A written response to these prompts assures that everyone's voice can be heard. Finally, these reading/writing responses model the types of critical analysis of text that is needed outside of the classroom. Whether it is reading the newspaper, a professional journal, or a political blog, people need to be able to identify problems or issues and interpret evidence. In a complex global society, people need to be able to challenge assumptions and take different points-of-view. To meaningfully understand new information people need to make connections to what they already know and make application of that knowledge to solve problems.

Andrew August (2000) suggests the use of a "Reader's Journal" in which students write informal responses to reading assignments. The entries are described as informal writing that is designed to improve students' reading and encourage their thinking. Students are asked to summarize the main points of the assigned reading and express their responses to it. August's research found that ninety percent of students agreed that the journal entry assignment made them more likely to do the out-of-class reading (August, 2000). A similar approach might be taken with these reading prompts by asking students to collate their responses throughout the semester.

Conclusion

The selection of good reading assignments has not been discussed in this article. However, it is implied that promoting critical reading with the use of questions requires that the reading selections are of value and interest to the reader. The reading materials that are offered to students should be those of the highest quality that will ignite their thinking and stimulate their intellectual curiosity.

Asking students to prepare for class by doing out-of-class reading is central to teaching and learning in the undergraduate classroom. Completing this pre-class work helps students to be more engaged in the in-class learning process (Ripley, 2007). As instructors, we can promote critical reading habits in our students by giving them significant and realistic purposes for their out-of-class reading. This is one way to facilitate a richer learning experience for students outside the classroom. The list of reading/writing prompts offered here is by no means exhaustive; in fact, they should only be used as a starting point to broaden the critical reading skills of other individual instructors' undergraduate students. Students *can* read and think at the same time: instructors just need to guide student critical reading with purposeful writing prompts.

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Developing a Culture of Assessment through a Faculty Learning Community: A Case Study

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This article describes how a diverse, interdisciplinary team of faculty formed a topic-based faculty learning community. Following an introduction to faculty learning communities and a brief discussion of their benefit to faculty engaged in the process of adopting new technology, we explain how our team, through a competitive mini-grant application process and intensive training workshop, complemented by a series of follow-up training sessions, formed a faculty learning community that collectively adopted a web-based rubric model for performance evaluation, began implementing it, and, in doing so, developed a culture of assessment. We describe the web-based rubric software we adopted and provide short reports authored by seven members of the faculty learning community to exemplify how the implementation of web-based rubrics can enhance student performance, augment instructor evaluation of student performance, and facilitate outcomes assessment. The article includes a "lessons learned" section which synthesizes what we learned from the endeavor and emphasizes what we considered critical to the group's success.

As the generation of students who have grown up with digital technology continues to enter the university, the demand for higher education instructors to integrate technology in the classroom increases. Yet the richness of the technology resources available to instructors complicates matters. Alongside the increase in expectations for university faculty to gain technological competence, there is an increase in technologies that were not available to them when they were attending college (Nugent, Reardon, Smith, Rhodes, Zander, & Carter, 2008).

Although Keengwe, Kidd, and Kyei-Blankson (2009) point out that the use of technology in higher education is increasingly persistent, it is generally focused on productivity tools such as word processors and spreadsheets, while the extended use of technology to perform, for example, learning assessment, occurs very seldom. Consequently, Keengwe et al. (2009) have emphasized the need for methods of training that demonstrate to faculty how technology can benefit them; that describe the benefits of learning new technologies as more significant than the costs; and that illustrate that it is possible to acquire technological skills at a rate they can best assimilate and apply.

A faculty learning community (FLC) as defined by Cox (2004) is an interdisciplinary group of about twelve or fewer faculty that meets regularly for an extended period of time with the focus of enhancing the teaching and learning process by working to increase its members' acquisition of new skills. When an FLC is created to address the needs pertinent to a cluster of individuals (e.g., first year faculty members, untenured faculty members, or full professors), the FLC is cohort-based. Alternately, an FLC can be topic-based, formed to explore a common issue for an interdisciplinary group of faculty (Cox, 2004; Nugent, et. al, 2008; Smith et al., 2008). Both types of FLC provide a forum for pedagogical discussion which can foster faculty development and, more specifically, which can enhance the integration of technology within the curriculum above and beyond the use of productivity tools.

In this article, we describe the process of creating a topic-based FLC centered on enhancing student assessment and on improving the quality of feedback provided to students. Following a description of the formation of the FLC, we discuss our adoption of web-based rubrics as tools for assessing student learning, and we provide a collection of "short reports" that exemplify individual FLC members' implementations of web-based rubrics. As evidenced in a number of the reports, a positive outgrowth of our work has been our ability to accumulate data on learning outcomes, which has extended the application of the rubric tools developed by FLC members beyond classroom implementation to include program- and college-level accreditation processes and which has facilitated the development of a culture of assessment within and beyond our FLC.

Background

Faculty Learning Community

According to Cox (2004), the qualities necessary for community in FLCs include safety and trust, openness, respect, responsiveness, collaboration, relevance, challenge, enjoyment, esprit de corps, and empowerment. The components of successful FLCs include a mission and purpose, curriculum (topics), administration, connections, affiliated participants, meetings and activities, scholarly processes, assessment, and enablers and rewards. These factors,

prerequisites to the success and endurance of an FLC, coincide with those that motivate faculty to participate in and practice the skills learned in technology integration workshops as described by Keengwe et al. (2009).

Moving a group of faculty to expand their use of technology beyond productivity tools and motivating them to advance to less known and less comfortable use of it requires a willingness to adopt change and to expose their lack of knowledge. While Sirum et al. (2008) point toward science instructors' isolationist approach to teaching and their resistance to change as impediments to best practices in science teaching, the problems of isolation and resistance to change are by no means discipline specific. These qualities are shared by faculty across disciplines and pose particular obstacles when faculty are confronted with the acquisition of technology-based pedagogical skills. Sirum et al. (2008) identify the formation of a cohort-based science FLC as crucial to life science instructors' success in adopting new approaches to teaching and student learning. Similarly, a topic-based FLC can serve as an enabling factor to nurture faculty in general in the integration of technology. In an FLC environment where trust and empowerment are integral to the group's dynamic, faculty are more willing to accept change and to try new approaches, especially when change and new approaches emerge from the group and everyone has the opportunity to contribute to the solutions (Long, Janas, Kay, & August, 2009; Smith et al., 2008).

Forming a Topic-Based Faculty Learning Community

Background Information

Bloomsburg University (BU) of Pennsylvania is one of the 14 member institutions within Pennsylvania's State System of Higher Education. As a four-year, public university, Bloomsburg University offers more than 80 programs of study leading to bachelor's degrees, 38 undergraduate minors, 18 graduate programs leading to master's degrees, a doctorate in audiology, and several certificate programs for professional educators. The student population consists of 8,000 undergraduate and 700 graduate students, most from the eastern half of Pennsylvania.

BU is in the initial phase of adopting a comprehensive, university-wide student outcomes assessment plan, which includes determining the software the university will use to collect and manage data. Currently, at the college and department levels, diverse approaches are being implemented to develop assessment plans, and faculty have been encouraged to develop measurements of student learning outcomes at the course and program levels.

The Assessment-based FLC at Bloomsburg University

Bloomsburg University's topic-based FLC was initiated when Celina Byers, a faculty member in the Department of Instructional Technology (College of Science and Technology), was seeking a rubric tool that provided specific feedback to students and articulated with Blackboard, the learning management system in place at BU. Based on research completed by Byers and Instructional Technology Specialist Regina Bobak, Waypoint software was selected for adoption on a university-wide level during fall 2007, with the aim of making the software available for use within individual courses as well as within the university-wide student outcomes assessment plan. To support faculty members in adopting the rubric tool, Sheila Jones, the University's Teaching and Learning Enhancement (TALE) Center director, and Byers organized and conducted a semester-long series of one-hour Waypoint training sessions. These training sessions were attended by a total of ten, self-selected faculty members, representing seven different academic departments.

While the initial objective aimed for in the training sessions was to support individual faculty members in the development of web-based, interactive rubrics to be used at the program or course level, evaluation data revealed faculty frustration with the training structure, particularly, a concern with continuity and a lack of motivation to complete the "homework" assignments between sessions. For these reasons, the primary training objective was not met, and when the semester concluded, participants had developed either incomplete rubrics or rubrics they were not prepared to put into practice.

Nonetheless, because Byers had experienced success incorporating a web-based rubric-driven performance evaluation schema in her courses, Jones and Byers persisted. As an incentive to encourage training participants to continue their work with web-based rubrics, Jones and Byers obtained University funds to offer a follow-up competitive mini-grant opportunity. Applicants for the mini-grants were required to submit an application including: (1) a proposal outlining their performance-based rubric project, (2) their goals and objectives for the project, and (3) the basic evaluation criteria for each of the main components addressed by the project. Recipients of the mini-grant were required to: (a) attend an intensive, three-day Waypoint workshop following the close of spring semester 2008, (b) attend three two-hour advanced Waypoint training sessions during fall semester 2008, and (c) conduct a one-hour TALE Center seminar for university faculty during spring 2009.

The mini-grant recipients were six faculty from six different academic programs: Business Education and Information and Technology Management (College of Business); Music, Theatre and Dance (College of Liberal Arts); Education of the Deaf (College of Education); Psychology (College of Liberal Arts); English (College of Liberal Arts); and Special Education (College of Education). Together with Jones and Byers, the team comprised one male and seven females, ranging in age from 33 to over 60, with university teaching experience ranging from one to 26 years.

In most cases FLCs are systematically developed with specific goals, objectives, and outcomes identified from the onset. In this instance, the competitive mini-grant opportunity and the intensive three-day training workshop, complemented by the follow-up training sessions, marked the beginning of an informal, assessment-based FLC which embodied all of the qualities of a learning community identified by Cox (2004).

Why Were Participants Successful in Forming an FLC?

Because mini-grant applicants self-selected and were required to submit a detailed proposal outlining their plans for a performance-based rubric project, those who received the mini-grants were highly motivated to participate in the workshop and to acquire new technological knowledge. And though mini-grant recipients were awarded a small amount of money for professional development ($200), they described the sense of community that formed during the workshop and training sessions, a community of "technology risk-takers" and "pedagogy explorers," as the most compelling enabler and/or reward.

The primary objective of each mini-grant recipient was foremost to become a better teacher. Consequently, the workshop curriculum focused on the construction of rubrics to enhance pedagogy. The workshop and training sessions were facilitated by both Jones and Byers, and the two formed a leadership combination which merged teaching and learning expertise with technology expertise. In this way, the workshop and training model ensured that the acquisition of new technological skill was consistently pedagogy-driven.

To fortify participant commitment to the workshop and training goals, the administration of the follow-up training activities was equally shared by all members. Together, participants identified training dates, times, and outcomes. Throughout the workshop and follow-up training, individuals were encouraged to exchange rubric projects, ideas, and suggestions so that what was learned individually was articulated to the group. Opinions and suggestions were freely expressed as participants shared successes and challenges. Further, individuals were empowered to define new goals and objectives for the group as rubrics were implemented, evaluated, and revised and as serious discussions emerged about the relevance of the group's work not only within individual classrooms, but also on a broader, university-wide scale. As a result of the sense of community, the climate of openness and respect, and the group's growing commitment to assessment as well as to pedagogy, the collaboration continued beyond the initial requirements stipulated by the mini-grant.

The FLC and a Culture of Assessment

The driving force stimulating the comprehensive assessment of student learning in higher education is the need to meet national and state accreditation standards. For some universities, including Bloomsburg University, the standards of the Middle States Commission on Higher Education and other college-specific accreditation agencies (e.g., National Council for Accreditation of Teacher Education; Association to Advance Collegiate Schools of Business) are the forces shaping comprehensive outcome assessment plans. The overarching goals for assessment systems in higher education are the systematic gathering, analysis, and use of data to monitor college students' performance and the improvement of an educational unit's operations and programs for the preparation of future professionals.

According to Palomba and Banta (1999), effective university-wide assessment plans incorporate six essential strategies: developing learning goals and objectives; planning for assessment; involving faculty, staff, and students in assessment; selecting and designing methods; reporting and using results; and assessing the assessment program. While these strategies serve as a foundation for building community consciousness and a culture of assessment, achieving faculty understanding of the relevance and the necessity for assessing student learning in both general education and higher level courses is essential.

Although our assessment-based FLC was formed primarily to support individual faculty in adopting new technology to enhance classroom assessment, the involvement and guidance of Jones as TALE Director inspired not only better teaching practices but also the integration of assessment theories and practices as well as an understanding of the pedagogical principles behind them. For this reason, the faculty involved quickly recognized the potential of their work with rubrics to support data collection for accreditation purposes and for university-wide assessment, leading to a culture of assessment within the FLC that eventually extended beyond its initial goals. The group's

Figure 1
Defining the Rubric in Waypoint

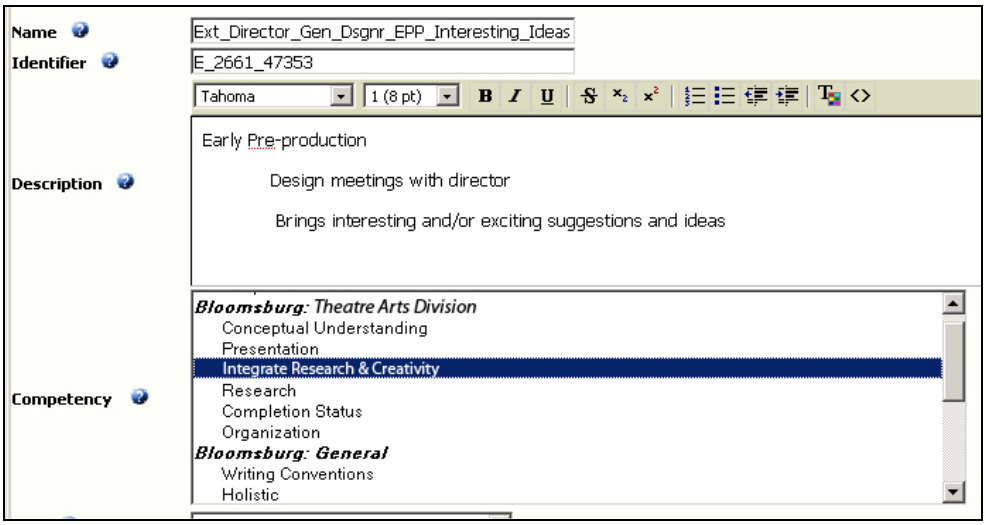
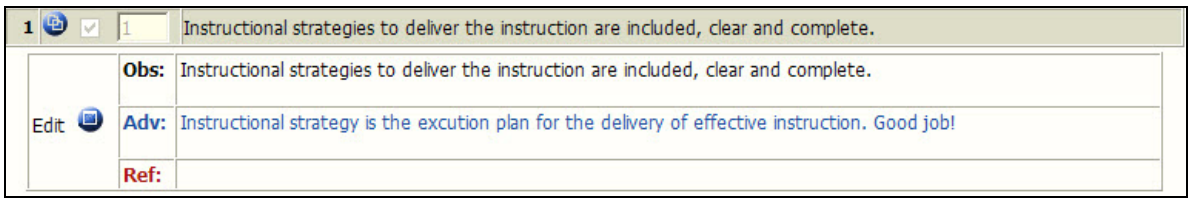


Figure 2
An Observation for a Rubric Element



knowledge and experiences were ultimately disseminated through discussions with colleagues from participants' specific academic departments. Eventually, in an effort to extend the culture of assessment being cultivated within the group, the FLC initiated discussions pertaining to the advantages and disadvantages of using Waypoint as the university-wide assessment collection software.

Web-based Rubrics

Instructional rubrics are designed to assess complicated or extensive projects by breaking down evaluation criteria into elements and indicating the consequences of including or excluding each element (Andrade, 2000). Web-based rubric tools such as Waypoint, developed by Subjective Metrics (see Figure 1) and designed to interface with the freely available rubric tool RubiStar, facilitate the building and use of digital, interactive rubrics and enable the online collection and storage of data for performance evaluation and outcomes assessment.

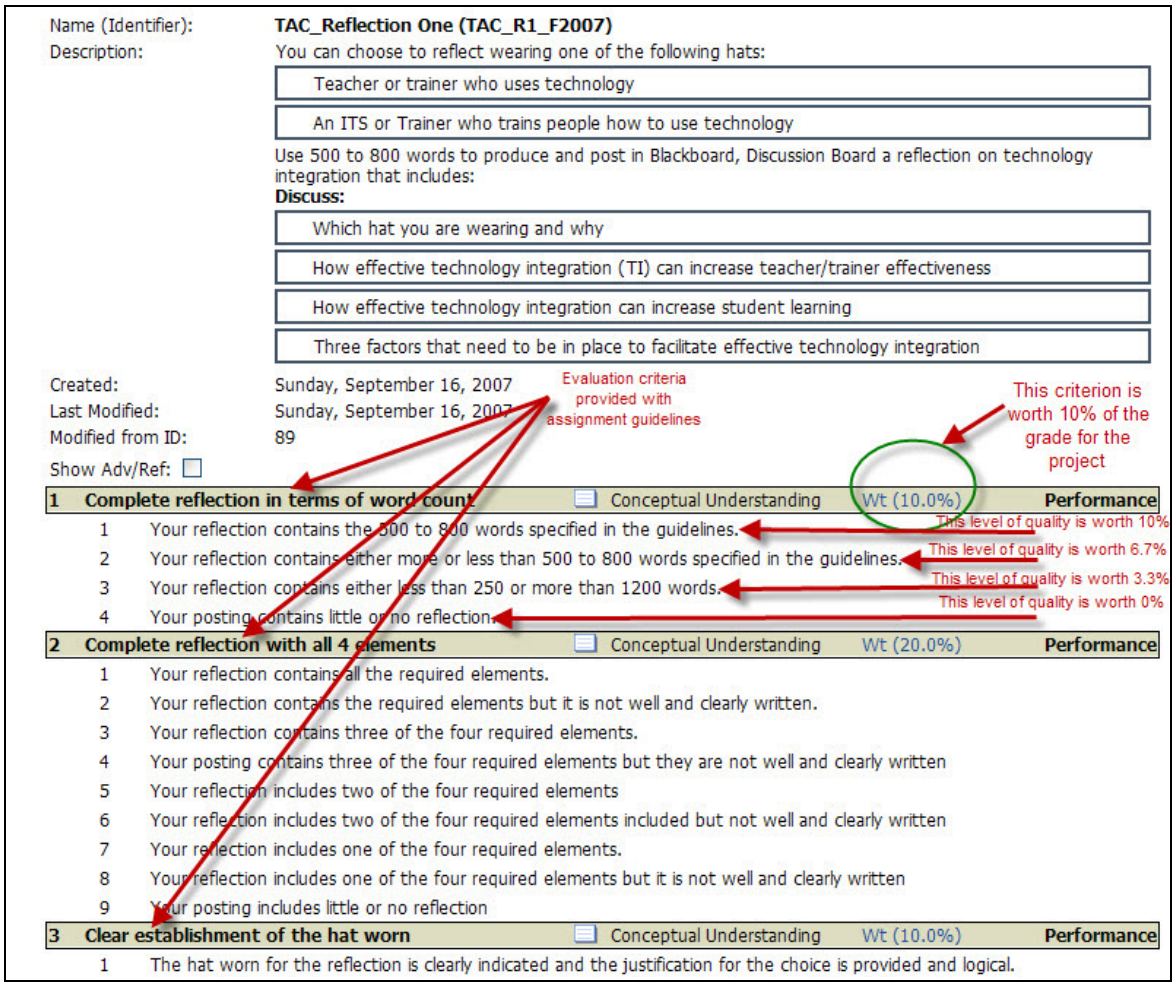
Moreover, web-based rubrics can optimize the grading process for teachers and students by standardizing it, saving time, and allowing teachers to provide specific and tailored feedback to each student.

Building Rubrics with Waypoint

Developing a web-based rubric in a tool such as Waypoint starts with the definition and input of *elements*. The rubric developer defines the criteria of an assignment that will be assessed. For each criterion, an element is created in Waypoint. An element can have different numbers of *observations* that define the quality levels used to evaluate the assignment. Each observation contains the description of the observation (Obs), a space for advice (Adv) that can be filled with a general comment (which will be part of the rubric for all students who received that mark for the criterion), and a space for reference (Ref) for further research on the topic, as illustrated in Figure 2.

After all the elements have been created, they are aggregated into an assignment as illustrated in Figure 3.

Figure 3
Partial View of an Assignment Created in Waypoint



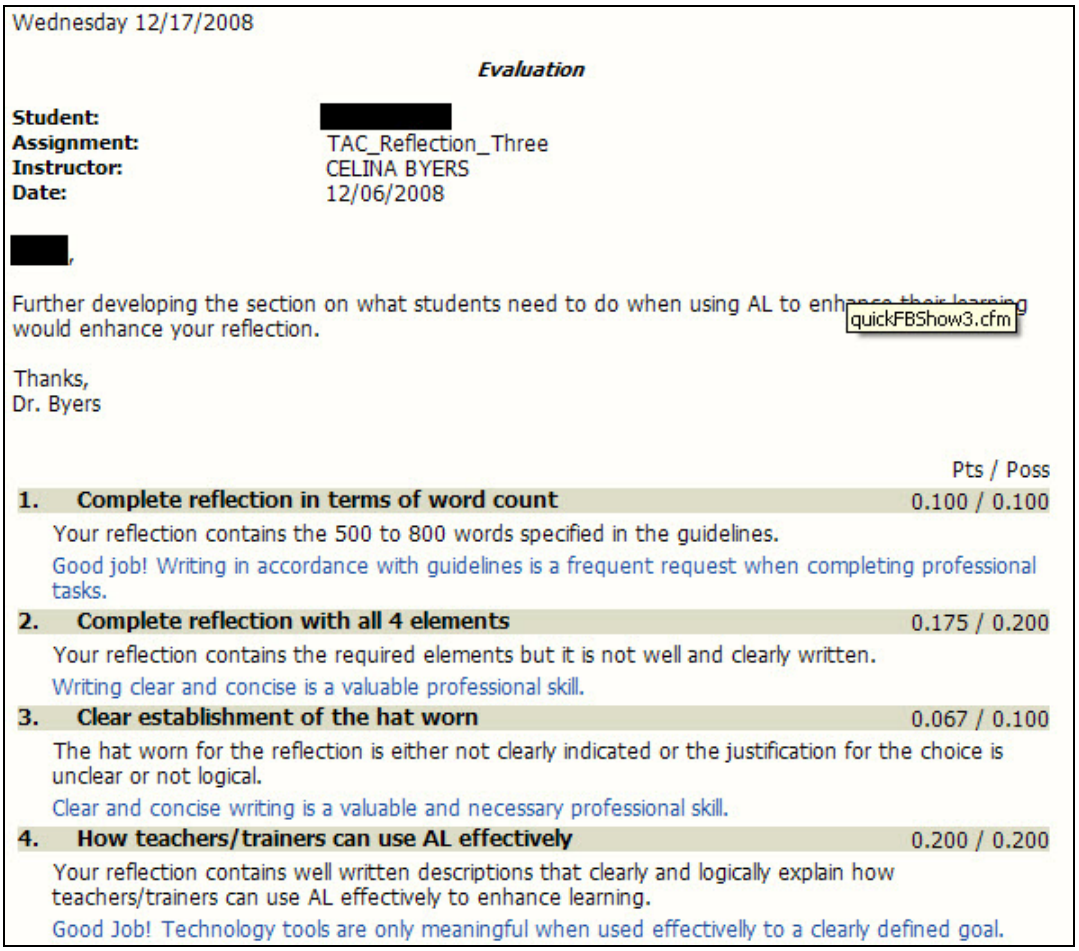
After adding all elements to an assignment, the percentage of points for each criterion can be distributed. When an assignment is completed, the instructor is ready to start evaluating the students' performance on that assignment. Waypoint integrates with course management systems (CMS) such as Blackboard, Moodle, and WebCT Vista. Therefore, the evaluation process is accomplished by the instructor's selecting a student from the enrollment list and, based on the student's project, assigning an observation for each of the elements within the assignment rubric. At the evaluation time, it is possible to further personalize the feedback to be sent to the students by adding additional comments in the advice or reference fields of the observation. Because students receive a detailed rubric for each assignment with customized feedback in areas they need to improve, they perceive that they are receiving individualized attention for each of the projects they produce. Figure 4 provides an example of the evaluation summary students receive (via email, CMS, or printed copy as determined by the instructor) for each assignment.

As a result of Waypoint's internal structure and design, instructors can re-use common elements for multiple assignments, and they can make their library of elements available to other instructors to use.

Rubrics as Assessment Tools

Central to accreditation agencies' assessment requirements are the dependability and reliability of the procedures that are designed to serve as accurate indicators of graduates' performance. Data from numerous, diverse research studies have shown the efficacy of rubrics for general education courses (Bresciani, 2007; Dunbar, Brooks, & Kubicka-Miller, 2006; Peat, 2006; Schneider, 2006) and higher level preparation courses (Pindiprolu, Lignugaris-Kraft,

Figure 4
Partial View of a Rubric Created in Waypoint



Wednesday 12/17/2008

Evaluation

Student: [redacted]
Assignment: TAC_Reflection_Three
Instructor: CELINA BYERS
Date: 12/06/2008

[redacted],

Further developing the section on what students need to do when using AL to enhance their learning would enhance your reflection.

quickFBShow3.cfm

Thanks,
Dr. Byers

		Pts / Poss
1.	**Complete reflection in terms of word count**	0.100 / 0.100
	Your reflection contains the 500 to 800 words specified in the guidelines.	
	Good job! Writing in accordance with guidelines is a frequent request when completing professional tasks.	
2.	**Complete reflection with all 4 elements**	0.175 / 0.200
	Your reflection contains the required elements but it is not well and clearly written.	
	Writing clear and concise is a valuable professional skill.	
3.	**Clear establishment of the hat worn**	0.067 / 0.100
	The hat worn for the reflection is either not clearly indicated or the justification for the choice is unclear or not logical.	
	Clear and concise writing is a valuable and necessary professional skill.	
4.	**How teachers/trainers can use AL effectively**	0.200 / 0.200
	Your reflection contains well written descriptions that clearly and logically explain how teachers/trainers can use AL effectively to enhance learning.	
	Good Job! Technology tools are only meaningful when used effectivelly to a clearly defined goal.	

Rule, Peterson, & Slocum, 2005; Song, 2006). Carefully researched, cogent rubrics can help educators respond to the need to promote consistency in scoring and to improve instruction, which, combined, can lead to improvement in student learning. Although there are different types of rubrics (e.g., holistic rubrics, analytical trait rubrics, generic rubrics, task-specific rubrics), all well-developed rubrics provide written scoring guides that can be used individually or by multiple teachers (Arter & McTighe, 2001). As a result, the determination of inter-rater reliability can be easily established for written rubrics that measure students' performance on curricular benchmarks.

Reports from FLC Participants

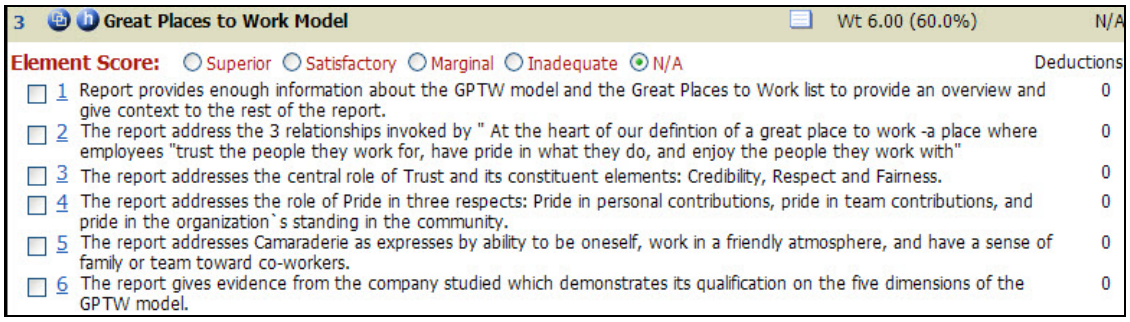
Ultimately, the six mini-grant recipients plus an additional faculty member from the College of Business authored short reports to describe their experience as adopters of web-based rubrics. Provided in the following section, these seven short reports reflect the range and scope of the FLC's collaboration, faculty members' diverse pedagogical and assessment goals, and the achievement of the Waypoint training's initial objective: the implementation of performance-based rubrics.

Ethan H. Krupp, MFA (Music, Theatre and Dance): Using Waypoint in Assessment Data Collection

One area theater programs often wrestle with is how to collect assessment data related to productions staged by the program. They are, by their very nature, one of the most collaborative art forms around. Separating the work of individuals can be a challenge, but doing so is necessary for tracking the development of individual students and the program as a whole.

My Waypoint rubric was developed to allow the theatre program directors to collect feedback on student designers in a consistent manner. The specific questions

Figure 5
Key Elements



on the rubric are all tied directly back to learning outcomes designed by the program and approved by our accrediting body, the National Association of Schools of Theatre. The advantages for us with Waypoint are that we can collect feedback for the individual student who worked on the show through the selections made on the rubric, and we can track trends across multiple shows with different student designers. Waypoint accomplishes this by allowing each element on the rubric to be linked back to unique learning objectives set up by the Theatre Arts Division. By seamlessly integrating detailed student feedback and monitoring performance related to learning outcomes, we are able to collect assessment data that was previously lost because we had no consistent data collection method and lacked the ability to strip out specific student identifiers.

Steve Markell, PhD (Department of Management): Developing a Waypoint Rubric for Reports by Student Teams in a Management Class

Organizational Behavior is a commonly required course for students seeking a Bachelor of Science in Business Administration with a major in Management. Students complete a first course in management and generally enter this course as juniors. The course covers social science topics across a range of perspectives, from individual (personality theory, physiological aspects of stress), to interpersonal (social perception, communication), to group (role structures and processes) and organizational (work design, organizational culture). The course is distinctive for its multidisciplinary and multilevel framework for describing the social context of work organizations.

Student team projects, a common course element, provide pedagogical advantages in engaging learners and meeting course goals which reflect The Association to Advance Collegiate Schools of Business (AACSB) accreditation requirements for students to demonstrate their ability 1) to communicate, 2) to use information technology, and 3) to understand individual and group dynamics in organizations. Since discussions in the text and classroom are multilevel and multidisciplinary, students are prone to become confused or overwhelmed. Team projects are intended to help students acquire an integrative framework for understanding the topical discussions. One of the team assignments begins with *Fortune Magazine*'s annual "100 Best Places to Work List." This list is developed for *Fortune Magazine* by the Great Places to Work Institute which conducts its own survey of employees and reviews company applications using criteria comprising its Great Place to Work Model. Student groups select a company from the list and prepare an oral presentation and a written report on the company practices that earned the company a place on the list.

I give students the rubric I use to evaluate the oral presentation and meet with each group after their presentation to go over their group and individual scores. For the written report, I wanted a way to deliver meaningful feedback to individual students. I use Waypoint to develop a rubric to assess writing conventions and the presentation's ability to communicate the substance of the Great Place to Work Model. The key element of the rubric appears in Figure 5.

Margaret O'Connor, DSc (Business Education and Information and Technology Management): Using Waypoint in Business Communications and Report Writing for Undergraduate and Graduate Levels

Writing research reports is a requirement for students within the College of Business, and Business Communications and Report Writing is taught by the Department of Business Education and Information and Technology Management. Business majors are required to take the course in place of Composition II during their fourth semester as undergraduates, once they have learned the basics of good writing and have practiced writing simpler messages such as memos, letters, and

negative messages. The same course is offered at the graduate level in the Masters in Business Education program for students who are new to the program. At the master's level, the course provides students a way to refresh themselves about proper business communications and how to write a communications research report.

In order to respond effectively to AACSB, Middle States, and National Council for Accreditation of Teacher Education standards for writing, assessment is critical in this course set. Waypoint supports the assessment process and provides a way to improve inter-rater reliability by using one digital rubric for evaluating both the paragraphs and the elements of the research report. Therefore, although several instructors teach the course, measurement of learning goals is standardized in a meaningful way.

For example, AACSB (2008) Guideline 15, *The Assurance of Learning Standards*, states that the management of the curricula must implement systematic documentation procedures to develop, monitor, evaluate, and revise the substance and delivery of the curricula of degree programs. Learning experiences and skill areas include communication abilities in oral and written form as well as the development of analytical skills, including statistical data analysis as it supports decision-making processes throughout an organization. The following capstone project is designed to elicit and evaluate students' communication abilities, as students must turn in the final project in lieu of a final exam. The project steps include

1. Students select a communications problem that they want to learn more about.
2. They decide whether or not they want to work in groups on the project.
3. Those who have chosen groups decide on one idea that interests all members of the group. This idea is approved by the instructor.
4. As students are learning the process of research report writing they are required to turn in homework assignments which break out the components of the research report. The main components are
    A. Introduction to the communications problem, including a short literature review of eight to ten references.
    B. The purpose statement, the scope of the project, timeline, budget, ethical considerations, methodology, including a literature review of eight to ten references as to other examples of communication studies that use similar methods.
    C. Sample size, instrument used to collect the data, data analysis procedures, key findings, discussion, limitations, and next steps.

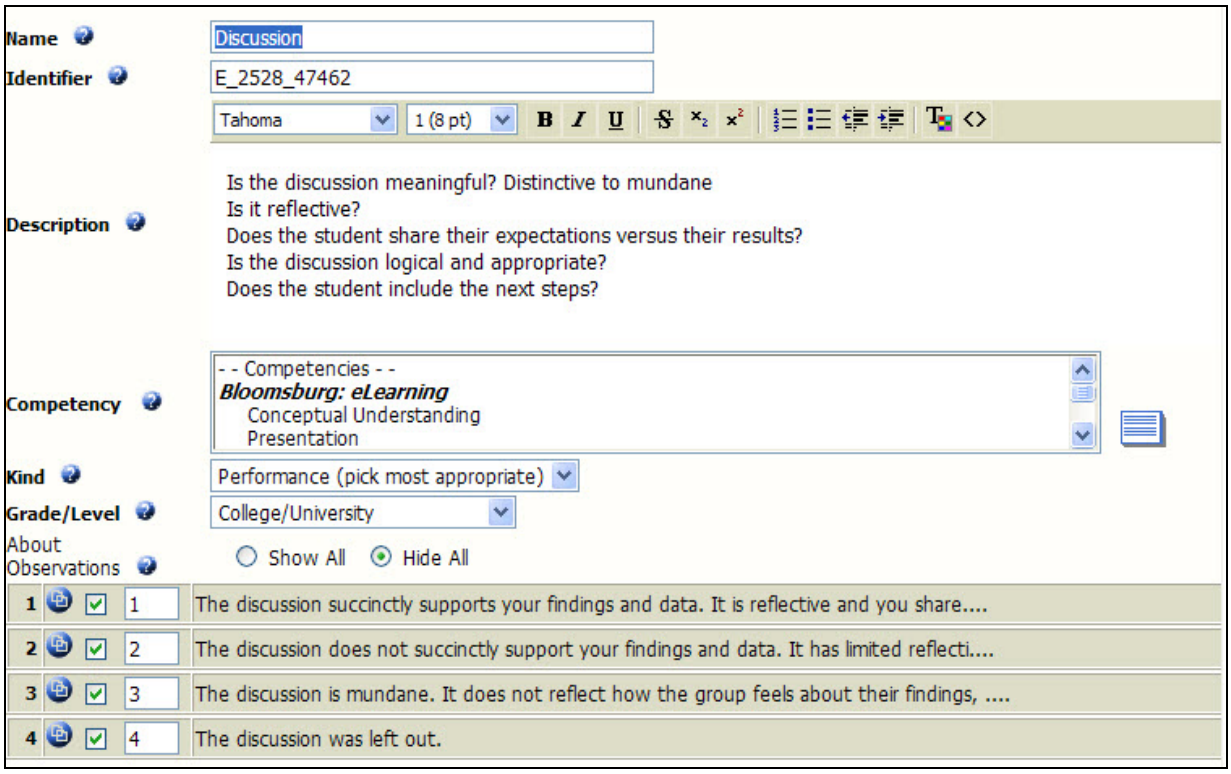
    Points are given and feedback is provided so that students may improve each component for the final paper. However, given the short period of time to do the entire project, students are on their own to develop 10 key findings and report on the study's limitations and discussion of the project.
5. Students follow APA guidelines, which they are already familiar with from Composition One.
6. Students are required to present their key findings to the class through a presentation, completed through Waypoint, during the last week of classes; the presentation is graded.
7. A peer review from classmates is given for the presentation completed through Waypoint.
8. Group members are required to do a peer review, completed through Waypoint, for each member who worked in their group to insure accountability of all group members.
9. Papers are turned in through Waypoint and graded according to the rubric components.

The Waypoint element shown in Figure 6 is designed to evaluate the discussion section of the research report, in which students are required to share what is important or interesting about the data and to make recommendations for organizations or future studies.

Yanhui Pang, PhD (Exceptionality Programs, Special Education): Using WayPoint for a Group Demonstration on Inclusive Practice for Undergraduate and Graduate Students

The Introduction to Exceptionalities course is taught by the Department of Exceptionality Programs. It is a mandatory course for all majors. The course reviews all major areas of exceptionality and acquaints students with the social, sociological, psychological, medical, historical, legal, economic, and professional aspects of disabilities. In addition, the course reviews current research and the latest techniques for facilitating meaningful interactions with individuals who have exceptionalities. Orientation to Exceptionalities is a graduate-level course which reviews the types of legislative support available for individuals with exceptionalities, including the right to education, employment, and entertainment, and reviews the

Figure 6
Discussion Section



appropriate and effective approaches for teaching individuals with disabilities.

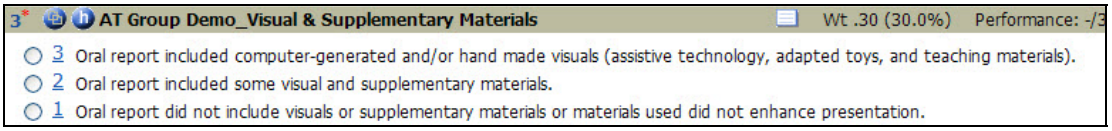
The selection and use of assistive technology to accommodate individuals with exceptionalities in inclusive settings and to help them reach their potential is critically important according to Council for Exceptional Children (CEC) Standards (2003). The standards state that special educators should "identify and use instructional methods and curricula that are appropriate to their area of professional practice and effective in meeting the individual needs of persons with exceptionalities" (CEC, 2003, p.1). Special educators also need to be able to select and use "appropriate instructional materials, equipment, supplies, and other resources needed in the effective practice of their profession" (p.1).

The group demonstration project aims to provide students an opportunity to apply the knowledge and skills they mastered in the Introduction to Individuals with Exceptionality and the Orientation to Exceptionality class to their work with children with exceptionalities and their families in inclusive settings. The project provides pre-service teachers an opportunity to develop inclusive plans and to utilize assistive technology to accommodate children's special needs in inclusive settings, thus promoting the understanding of the importance of inclusion.

The group demonstration project steps include

1. At the beginning of the semester, the students are grouped into groups of four based on their interests and ability levels.
2. Each group picks an appropriate topic covered in the Introduction to Individuals with Exceptionality textbook. Guidelines are distributed at that time.
3. Each group has to meet with the instructor to go over their thoughts, their draft of their PowerPoint slides, and their visual/hands-on materials. The instructor gives them advice, suggestions, and comments.
4. Students make revisions accordingly.
5. In the actual demonstration, students present their case, going over the disability category including the definition, characteristics, and teaching strategies. They spend an equal amount of time talking about the specific child with the disability they have had a chance to work with, know of, or hear from, and showcase the teaching strategies and/or

Figure 7
Rubric Element



assistive technology they have designed, adapted, or borrowed to address the child's special needs in the inclusive setting and to work with the child and his family.

6. As shown in Figure 7, students' demonstrations are evaluated based on the relevance and recent resources they used to develop and design the project, the depth they go into when discussing the topic, the visuals and supplementary materials they used to demonstrate how to accommodate the individuals' special needs in inclusive settings, and the organization and professionalism demonstrated in the project. The group receives the final evaluation report within a day or two after the demonstration and may present any questions they have regarding the evaluation report.

The group demonstration project improves students' collegiality and collaboration with peers. It provides students a deeper understanding of inclusiveness, such as the special challenges, the accommodations, the collaboration with the child's family, and the important roles the educators/practitioners play in the service delivery process. Students learn to use every possible means to meet children's special needs, and students' positive feedback indicates the explicitness of the rubric.

Alicia King Redfern, PhD (Psychology): Using Waypoint and Blackboard to Assess Student Learning in Psychology

According to Fink (2003), course instruction and student learning are improved when course objectives, student learning activities, and course assessment techniques are integrated with each other. A demonstration of how these concepts are being utilized in a psychology course on Psychological Tests & Measurements is presented below.

As a part of the requirements for psychology majors, students must take six upper-level psychology courses, of which one option is Psychological Tests & Measurements. As stated on the course syllabus, the course has six objectives. The following three are pertinent to this illustration: 1) to have a thorough understanding of major psychometric properties of psychological tests, 2) to be able to administer and interpret the results of a standardized test, and 3) to be able to work collaboratively in small groups to enhance their mastery of course concepts. Toward these ends, students are required to administer and score a "real" psychological standardized test - under the supervision of the instructor - and then to make a classroom presentation on the test using PowerPoint slides.

To facilitate this process, Waypoint and Blackboard are utilized. Blackboard is used to communicate the guidelines of the assignment to students and to maintain their grades for the assignment. A rubric is developed for the assignment using Waypoint. The rubric contains well-defined performance criteria that tie course objectives to student learning and assessment activities. Students are sent an advanced copy of the Waypoint rubric through Blackboard in order for them to know what is expected of them and how the assignment will be graded, thus enabling them to maximize their performance. Since the assignment requires students to make live classroom presentations, the instructor, using a laptop, is able to grade students' performance using the Waypoint rubric and then simultaneously to post their grades to Blackboard's gradebook and send students a copy of their graded rubric.

The specifics of the assignment include a general description of the content and grading procedures for the student presentations. For example, the general content and grading procedures for the student presentation are as illustrated in Figure 8.

In the Waypoint rubric, the general guidelines listed in the assignment are transformed into well-defined performance criteria. The resulting criteria not only tie the course objectives to the students' presentations and assessments, but, as importantly, enable the students to more actively engage in the assignment. For example, items #1 (Test Description), #2 (Test Administration & Scoring), and #5 (Group Assessment) listed in the guidelines document are transformed in the Waypoint rubric as shown in Figure 9.

Without a doubt, integrating Waypoint with Blackboard has been extremely effective in enhancing course instruction, as well as improving students' learning and performance. By integrating student learning and

Figure 8
Content and Grading Procedures

Project Content & Grading: 200 Total Points

1. **Test Description: 20 points**
   - Title
   - Author
   - Publisher
   - Year published
   - Description of what test measures and how it measures it

2. **Administration & Scoring Procedures: 60 points**
   - Administer test to another group in the class
   - Score other group's tests
   - State what the test requires examinee to do
   - State how is it scored
   - State how are scores interpreted
   - *Provide an example - suggest presenter discuss his/her test results*

3. **Test Reliability & Validity: 40 points**
   - What is the reliability of the test (reliability coefficient and what it means)
   - What is the validity of the test (validity coefficient and what it means)

4. **Test Critique: 40 points**
   - Provide name and credentials of reviewer
   - State at least three (3) strengths of test
   - State at least three (e) weaknesses of test

5. **Group Assessment: 20 points**
   - Was group cohesive (i.e., introduce one another and supportive of each other)?
   - Were tasks equally divided among group members?
   - Did the presentation flow smoothly?
   - Was presentation within 20-minute time limit?

6. **Individual Assessment: 20 points**
   - Did individual speak well (i.e., volume, speed and diction)?
   - Was individual professionally attired (i.e., no jeans or sneakers)?
   - Was individual audience-centered rather than instructor-centered?

Figure 9
Rubric Elements

1	**Administering The Test**	Multiple	Wt (5.0%)	**Performance**
	1	Test directions were clear and examinees` progress was monitored.		
	2	Test directions were clear but examinees` progress was NOT monitored.		
	3	Test direction were NOT clear but examinees` progress was monitored.		
	4	Test directions were NOT clear NOR was examinees` progress monitored.		
2	**Scoring The Test**	Multiple	Wt (5.0%)	**Performance**
	1	All tests were scored correctly.		
	2	One or two tests were scored INCORRECTLY.		
	3	Three or more tests were scored INCORRECTLY.		
3	**Group Assessment**	Multiple	Wt (10.0%)	**Performance**
	1	Group perfomed at the HIGHEST level. SUPBERB demonstration of group cohesiveness, equal division of tasks, and organization.		
	2	Group performed at a HIGH level. VERY GOOD demonstration of group cohesiveness, equal division of tasks, and organization		
	3	Group performed at SATISFACTORY level. ADEQUATE demonstration of group cohesiveness, equal division of tasks, and organization.		
	4	Group performed at a LOW level. LESS THAN SATISFACTORY demonstration of group cohesiveness, equal division of tasks, and/or organization.		
	5	Group performed at LOWEST level. LITTLE demonstration of group cohesiveness, equal division of tasks, and/or organization.		

assessment activities with course goals, course instruction and teaching activities have become more integrated and consistent. As a result, students seem to be having more "significant" learning experiences – that is, informal feedback from students indicates that they have found the rubrics to be very help in preparing for assignments and in understanding how assignments are graded, and they are appreciative of receiving immediate feedback on their performances. In conclusion, using Waypoint rubrics on Blackboard has resulted in the instructor becoming more coherent, clear, and interactive in developing course learning and assessment activities that are compatible with course objectives, and, in turn, has enabled students to become more proficient and self-directed learners.

Stephanie A. Schlitz, PhD (English): Adopting Web-based Rubrics to Enhance the Teaching and Evaluation of College-level Writing

The National Council of Teachers of English (NCTE, 2008) recognizes that "Developing, researching, and validating a writing assessment is a constant process..." (p. 3). While engaging in this assessment process can prove challenging for any college-level writing instructor, I have found that with support from web-based rubric software such as Waypoint, I can more effectively evaluate students' writing and can more readily maintain doing so as an ongoing aspect of my pedagogy. Digital rubrics are flexible, transparent, and easily modifiable. By adopting a digital rubric model and by adapting my existing evaluation criteria to correspond with the element and observation format defined by Waypoint, I have been able 1) to assess and to respond to students' writing in an efficient, electronic format that stores my evaluations for future reference; 2) to compare performance within and between students and writing assignments online via a secure web application; and 3) to test the validity of my evaluation criteria, to begin researching their clarity from a student perspective, and to modify and then to reuse them in a new rubric as the assignment and writing context evolve.

NCTE (2008) standards further state that "students should have access to the goals, purposes, and scoring criteria for required assessments" (p. 3). The challenge of responding to this Principle of Effective Writing Assessment is often practical – especially for teachers who use electronic media as a primary mechanism for communication. Because Waypoint interacts with Blackboard, the CMS supported by Bloomsburg, I have been able to share the rubrics I've developed for the writing assignments my students complete alongside the assignment requirements, creating an environment where assignment goals, purposes, and scoring criteria are accessible to students in a web format they can refer to repeatedly.

Although I would recommend the adoption of a web-based rubric model to other writing instructors, adapting to this new model did pose some challenges for me. For example, the challenge imposed as I was forced to modify my evaluation criteria to match the architecture of a specific software model was an impediment, though one offset by the training workshop and team adoption model. Also, the necessity to restructure my evaluation process to compensate for Waypoint's inability to allow context bound feedback and its inability to capture the subtleties of evaluation many writing assignments demand were further impediments. Nonetheless, in my experience, rubrics do serve to focus student writers and to focus instructor evaluation of students' work. I am finding that web-based rubrics in particular offer an efficient, quantitative data collection method that can augment my evaluation of students' writing, can contribute to improved student performance, and can be extended to support the evaluation and improvement of writing pedagogy.

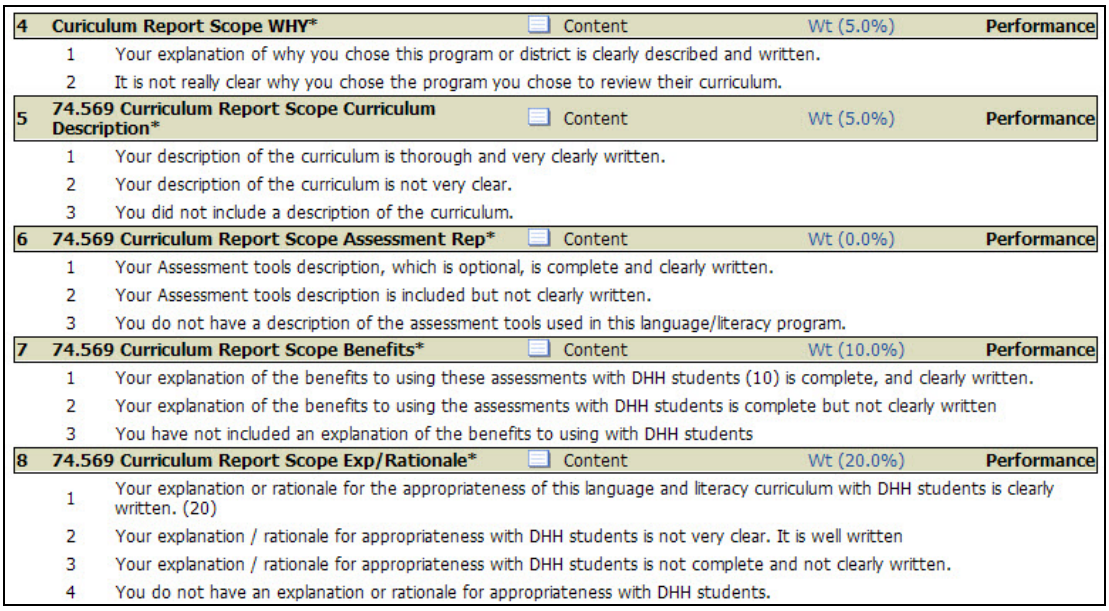
Deborah Stryker, PhD (Special Education: Education of the Deaf): Using Waypoint in Report Writing and Presentation for Undergraduate and Graduate Levels

As a faculty member teaching in both a traditional classroom format as well as a distance learning format when preparing students to become teachers of Deaf and hard of hearing (Dhh) children and youth, I found the use of a performance-based rubric to be most helpful in more clearly defining assignment parameters. In addition to facilitating clarity in the structure of the assignment, which was based on the standards established by the Council on Education of the Deaf (CED) and the Council for Exceptional Children (CEC), it facilitated my ability to define the level of performance I expect from each student, providing me with a more fair and consistent means of grading and providing feedback to my students. Another bonus to the use of Waypoint was that it shortened my grading time because I was able to (a) build written descriptions of common errors into the rubric and (b) distribute the feedback very efficiently by just pressing the icon "email."

Curricular Subjects for the Deaf and Hard of Hearing is a required methods course for students wanting to become teachers of Dhh children and youth, and it is offered online with synchronous and asynchronous learning formats. It is a dually listed course; that is, students have the option of taking this course as a graduate student or as an upper level undergraduate course elective.

The process of developing my Waypoint rubric for the assignment "Language/Literacy Research Report: Curriculum and/or Assessments Used When Teaching

Figure 10
Research Report Scope Elements



4	**Curiculum Report Scope WHY***	Content	Wt (5.0%)	**Performance**
	1	Your explanation of why you chose this program or district is clearly described and written.		
	2	It is not really clear why you chose the program you chose to review their curriculum.		
5	**74.569 Curriculum Report Scope Curriculum Description***	Content	Wt (5.0%)	**Performance**
	1	Your description of the curriculum is thorough and very clearly written.		
	2	Your description of the curriculum is not very clear.		
	3	You did not include a description of the curriculum.		
6	**74.569 Curriculum Report Scope Assessment Rep***	Content	Wt (0.0%)	**Performance**
	1	Your Assessment tools description, which is optional, is complete and clearly written.		
	2	Your Assessment tools description is included but not clearly written.		
	3	You do not have a description of the assessment tools used in this language/literacy program.		
7	**74.569 Curriculum Report Scope Benefits***	Content	Wt (10.0%)	**Performance**
	1	Your explanation of the benefits to using these assessments with DHH students (10) is complete, and clearly written.		
	2	Your explanation of the benefits to using the assessments with DHH students is complete but not clearly written		
	3	You have not included an explanation of the benefits to using with DHH students		
8	**74.569 Curriculum Report Scope Exp/Rationale***	Content	Wt (20.0%)	**Performance**
	1	Your explanation or rationale for the appropriateness of this language and literacy curriculum with DHH students is clearly written. (20)		
	2	Your explanation / rationale for appropriateness with DHH students is not very clear. It is well written		
	3	Your explanation / rationale for appropriateness with DHH students is not complete and not clearly written.		
	4	You do not have an explanation or rationale for appropriateness with DHH students.		

Students who are Deaf or Hard of Hearing" began from my desire to better communicate the expectations of the assignment. For this assignment, I require the students to research, review, and report on a language and literacy curriculum, the assessment tools that are used when teaching students who are Dhh and the benefits of this curriculum and the assessment tools to students with a hearing loss. The final project includes three components: an APA research report, an online synchronous presentation, and a one-page overview handout.

To illustrate the correlation between my performance-based assessment and the *CED/CEC Instructional Content and Practice Standard: Student will be knowledgeable regarding curricula and instructional strategies used in general and deaf education* (Council on Education of the Deaf, 2003), a section of my rubric is provided in Figure 10.

While the learning curve I experienced when developing my first Waypoint grading rubric was challenging, mainly because of the terminology differences between Waypoint rubrics and standard rubrics (e.g. rubrics are referred to as *assignments*, criteria are *elements*, and the many descriptors of performance are *observations)*, the benefits have far outweighed those initial problems. I have since developed more Waypoint rubrics and am currently researching my students' attitudes toward the use of this kind of feedback.

Lessons Learned

The motivation that led the group of faculty to form and sustain the assessment-based FLC was the shared commitment to becoming better teachers. In our case, improving pedagogy involved learning new technology, and FLC members reinforce what has been pointed out in the literature: FLCs offer a wonderful way to demystify technology-related training because they enable effective participation and encourage participants to embrace what they learn during training. For members of this FLC, the three-day intensive workshop was an essential element towards the acquisition of new technological skills, and, significantly, FLC members note the importance of having felt safe to acknowledge failure and to learn from mistakes throughout the workshop. FLC members also describe the follow-up meetings as essential for the continued development and integration of web-based rubrics and emphasize the role of these meetings in fostering ongoing collaboration.

Participants stress that the group's diverse make-up, including faculty at different ranks (from assistant to full) and at different stages in their career and experiential backgrounds, enriched the community experience. They note the benefits of working with colleagues across departments and colleges and of developing interdisciplinary affiliations that contributed to the overall esprit de corps of the group. Although

participants elected to participate by submitting mini-grant proposals, the selection of mini-grant recipients was competitive, and individuals report feeling supported not only by the small fund provided by the mini-grant, but also by the opportunity to blend social and professional activities, to share the workload, and to gain insight from colleagues.

Engaging in scholarly processes further contributed to the cohesiveness of the FLC. For example, the group has presented internally at a university TALE meeting and externally at an academic conference. Members of our team have also collaborated on an Institutional Review Board approved survey designed to collect data from students who agree to evaluate their experience as users of web-based rubrics (a summary describing the results of this study is forthcoming).

Perhaps most significantly, our FLC members underscore the importance of having established a clear link between technology, assessment, and pedagogy from the onset of this endeavor. Our facilitators were experienced faculty who were also experts in the technology we adopted, and the topic of assessment was explicit from the project's inception. Throughout our work together, the acquisition of new technological skill and the emphasis on assessment have consistently been driven by pedagogical aims.

Conclusion

The energy level and the focus of the FLC stimulated the decision to share our "lessons learned" as we continued collaboration by co-authoring this article. In essence, sharing the model and strategies we used as we endeavored to juggle the scholarship of teaching and learning brought synergy to the team. Moreover, it enabled us to reflect on the development and the outcomes of our assessment-based FLC. Our research, experience, and practice demonstrate that when a self-selected team of technology risk-takers and pedagogy explorers is provided with training, resources, and organizational support, one outcome is the formation of an FLC. When the FLC is driven by assessment goals, such as the construction and implementation of a web-based rubric designed to enhance performance-based assessment, the development of a culture of assessment is achievable.

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