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Active Learning Via Student Karaoke Videos

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We evaluated students' perceptions and reactions to an active learning Karaoke Video project in both a large (104 student) undergraduate class in Natural History of Georgia and a small graduate seminar in Fish Ecology. Undergraduate responses were evaluated with both questionnaires and triangulation interviews and graduate student responses evaluated with interviews alone. There was a slight majority of first and second year students (64%) in the undergraduate class. Students' majors/proposed majors were dominated by non-science categories, with 76% reporting non-science and 11% reporting science (13% no response). The overwhelming response of students to the 10 question Karaoke Video project questionnaire was positive ($p << 0.0001$), and 83% responded that the project aided in learning class material. Triangulation interview responses from undergraduate students supported questionnaire results, and graduate students also generally perceived the exercise as positive. Our results indicate that both undergraduate and graduate students responded positively to the Karaoke Video project and that these responses did not vary over several potential inter-student biases. This project was completed with the approval of the Institutional Review Board of the University of Georgia.

University education in the introductory biological sciences is driven mainly by passive education praxis, with a faculty member standing behind a podium lecturing and students sitting in place taking notes or perhaps just watching slides on a screen (Grossman & Watson, 2015; Orth 1995). Nonetheless, educational research has shown that active learning is a much more effective form of instruction, promoting increased understanding and retention (McKeachie Pintrich, Lin, & Smith, 1987), in addition to increased engagement of critical thinking and synthetic faculties (Freeman et al., 2014; Prince, 2004). Bloom's educational taxonomy (Krathwohl, 2002) suggests that students learn best when instruction includes activities that invoke higher order processes such as analysis, application, evaluation, and most importantly, the actual creation of new material (i.e., active learning). Nonetheless, there is scant published material on active learning approaches for introductory-level university biological science classes, especially those designed for non-science majors.

Active learning exercises do exist for both third- and fourth-year specialized classes in the biological sciences and for graduate classes. These typically involve laboratory exercises or computer simulations in which students perform thought experiments or use games in order to explore the effects of different solutions or attain a desired outcome (e.g., competition and coexistence between species, stable populations in the face of exploitation and environmental variation, and effects of varying harvesting strategies on yield). These exercises sometimes have structural proscriptions that limit the creativity of the student, although this is not a requirement for all exercises. Nonetheless, non-science majors may never take science classes that involve active learning activities, especially given they may only take one or two science classes in their entire college career.

In this paper we describe a Karaoke Video active learning project that engages students on higher cognitive levels (Krathwohl, 2002), and we evaluate both undergraduate and graduate student responses to the project via a questionnaire (undergraduate only) and triangulation interviews. The use of music to impart information has multiple positive effects on student motivation in a variety of science and non-science classes and at a variety of educational levels (see Grossman & Watson, 2015 and references within; Iverson & James, 2011). In this study, we evaluated students' perceptions and reactions to the Karaoke Video project via a ten question, Likert-based questionnaire, and we used demographic data to test the null hypotheses that rank in school, musical ability/experience, and correct or incorrect reporting of their highest exam score did not affect the frequencies of responses to questions. In addition, we examined whether these variables affected students' expressed preferences for their favorite activity within the project (e.g., writing lyrics, writing music, singing, researching material, and technical production). Finally, although the specifics of our article are directed towards biological science classes, it is likely that these techniques may be successfully employed by instructors in diverse disciplines.

Methods

This study meets the guidelines, and was conducted under the approval, of the Institutional Review Board of the University of Georgia. It was conducted in both the senior author's undergraduate Natural History of Georgia class and Fish Ecology graduate seminar at the University of Georgia. The natural history class is a first-year university course designed for non-science majors, although it is open to

all students. The class meets the university Environmental Literacy requirement for all students and a life science requirement for most colleges within the University of Georgia. The fish ecology graduate seminar covers a variety of aspects of fish ecology in a blended-learning format. Three students in the graduate seminar completed the assignment and consented to be in the study. Final enrollment in the natural history class was 104 students, and 85 consented to participate in the study. In the graduate seminar, the karaoke video was an individual project that counted for 33% of the total grade, whereas in the natural history class it was a four-person group project representing 12% of the total grade.

For both classes, a description of the Karaoke Video exercise was included in the syllabus which was made available on an electronic classroom management platform the first day of classes (week 1 of a 15-week semester). The platform used by the university was an interim system and hence the dates listed are approximate. In both classes the karaoke rubric was given out in the 12th week of class, and the videos themselves were due at the end of the 14th week of class. Final videos with names removed were shown in week 15, the last week of both classes.

We manipulated group structure in the undergraduate class by assigning one student who had earned an A on the course's first exam to each group, although some groups had more than one A student. We made no other efforts to standardize groups, and we believed that randomly assigning the remaining students to groups was the most tractable manner of equalizing inter-group differences in musical, academic and technical ability. This prevented students from forming groups based on social relationships that likely were correlated with ability. In both classes, students were introduced to the exercise via a similar rubric (rubric for Natural History of Georgia is Appendix) and instructions in class. One class session was devoted to group work on the video, and students were informed via both electronic and lecture media that the instructor also was available to help with the project during work hours. To facilitate videos on species, students were provided with 102 video clips of animals: tiger swallowtail butterflies, fireflies, black rat snakes, eastern chipmunk, eastern gray squirrel, copperhead snake, southern dusky salamander, and fiddler crabs. Students also were permitted to use videos and music obtained from the internet or other sources (Appendix).

Questionnaire

We presented students from the natural history class with a questionnaire containing a mixture of 16 questions dealing with basic demographic information and perceptions of the Karaoke Project. The questionnaire was administered during class but prior to exposure to the videos of other students. The questionnaire included the following demographic information: 1) year in school, 2) general major (science or non-science), 3) specific major (life sciences, business/engineering, journalism/political science, family and consumer science, and education), 4) level of musical experience (advanced [song writing, performing], good [sing and memorize songs], (c) average [listen to music regularly can sing a few songs], weak [don't sing or memorize songs] and non-existent). For ease of interpretation and statistical rigor, we combined advanced and good (high musical ability) response categories and weak and non-existent categories (low musical ability). Students also were asked to identify their highest exam score (A, B, C, D, F) out of three exams and their class attendance score (8 haphazardly taken roll checks, 7-8, 5-6, 3-4, 1-2, 0). Finally, students were asked to identify the type of video: class concept (mimicry, interspecific competition, predation, etc.), a habitat type, or a plant or animal species. Because the questionnaire was signed we could compare aspects of demographic information (highest grade, attendance score) with actual data. The questionnaire contained nine additional questions regarding the Karaoke Project (Table 1). Possible answers to these questions involved the following choices from a Likert scale: completely true, somewhat true, somewhat false, and completely false. For ease of interpretation and statistical analyses, we classified answers of completely and somewhat true as positive responses and somewhat false and completely false as negative responses. This did not obscure patterns in the data, and the full answers are shown in Table 1. Questions were posed in both positive and negative modes, and for statistical analyses we reversed the classification of negative mode questions. For example, Question Four was: "I prefer an additional exam rather than the video assignment," and students who replied "somewhat false" and "completely false" were scored as having responded positively to the karaoke project (i.e., they did not prefer having an exam in place of the Karaoke Video project). The questionnaire was validated via review by researchers and graduate students. Because there were so few graduate students in the fish ecology seminar, we assessed their perceptions of the karaoke project via triangulation interviews alone.

Triangulation

Questionnaire results also were validated via triangulation with post-class interviews. For the natural history class, seventeen students originally agreed to participate in triangulation interviews, but only four actually participated, even after repeated reminders and the incentive of a chance at a gift card. Triangulation

Table 1
Student Perceptions of the Karaoke Video Project

Question	Completely true %	Somewhat true %	Somewhat false %	Completely false %
1. Making the karaoke video enriched my experience in class.	18	57	20	5
2. I didn't understand the purpose of the video assignment.	7	25	27	41
3. The video helped me learn material.	31	52	15	2
4. I prefer an additional exam rather than the video assignment.	13	9	17	61
5. My group functioned well and work was evenly distributed.	61	31	6	2
6. Making the video was a waste of my time.	6	12	33	49
7. My video experience would have been more positive if the groups were supervised by a TA or instructor.	5	14	25	56
8. Having a group project enhanced my experience in class.	34	44	13	9

Note. Total sample size is 85 students, answers are percentages

interviews were conducted two months after the end of the semester. There were only three students in the graduate seminar; all consented to join the study and were interviewed. The junior author had no previous contact with undergrads and limited contact with graduate students; hence, he conducted triangulation interviews via telephone. Interviews were transcribed by hand and checked against recordings for accuracy. We asked seven questions: 1) How was your learning affected by the Karaoke Video project?, 2) Were there specific aspects of making the video that aided your learning?, 3) What do you think the purpose of the video assignment was?, 4) Should anything be changed about the video project?, 5) How was working in a group beneficial to your learning experience, and how was it detrimental?, 6) Do you have any other comments on the Karaoke Video project?, and 7) How did seeing your video in class make you feel?

Statistical Analyses

We tested a variety of hypotheses using pooled student questionnaire response data (i.e. total number of positive responses out of nine total). We used parametric statistical tests that are robust to deviations from normality. First, we used a t-test to evaluate the hypothesis that students reported significantly more positive responses to questions about the Karaoke Video project than negative answers (Table 1). Second, we used the same statistic to test the null hypothesis that there were no differences in the number of positive responses by students who correctly reported their highest exam score and students who reported a higher exam score than actually earned. Third, we used a t-test to test for differences in positive responses between first- and second-year students and students in their third year or higher. Fourth, t-tests were used to evaluate whether students with different characteristics (i.e., first and second year vs. third year and above; students who correctly reported their highest exam score vs. those who reported a higher score) differed significantly in their preferences for different aspects of the karaoke project (i.e., writing lyrics, writing music, singing, researching material, or technical production). Finally, given that students had three levels of musical ability/experience, we used ANOVA to test the null hypothesis that students with high, average, and low musical abilities did not answer questions with different frequencies. Statistical calculations were performed using R.

Results

Examples of Video Texts

We selected example texts based on their ability to represent the concepts of the exercise. The three examples are representative of the videos in general but are slightly better than the "average" video, although the level of performance in general was very high. We corrected grammatical errors, but minor scientific errors remain in the lyrics. Anonymous examples of student videos may be viewed at www.youtube.com/watch?v=jHihqV7alMg .

Class concept video. Mimicry: "Here's a song about mimicry; Mullerian, Batesian, Wasmanian, and Aggressive—whoa, let's jump right in. Mullerian, we're together to survive; we look alike; if you eat us, you will die. This is all so crazy, predators learn to stay away. Johan Muller studied butterflies in Brazil; he saw convergence in some species, such as the Viceroy and the Monarch queen; they evolved to look alike; neither of them want to die, so they live side by side. I'm a Batesian mimic; I'm scaring them away; they won't mess with me today. I've evolved to look like I resemble a toxic guy. Aposomatic is how I get by; my colors gonna keep 'em away. Yeah, I'm not gonna die today. Yeah, I'll live to see another day. On to Wasmanian mimicry; it's the third kind that we learned. The mimic hides from predators by living with the model. A good example of this mimicry is the salticid spiders living in ant colonies. The spider's actually a predator; the ants are their source of prey. Small brown trout looking for a good meal, sees a worm, and he gets it. That's when the turtle chomped down on his head; it was aggressive mimicry. Turns out it was just a trick, wasn't a worm; it was his tongue. I'm a Batesian mimic; I'm scaring them away; they won't mess with me today. I've evolved to look like I resemble a toxic guy. Aposomatic is how I get by; my colors gonna keep 'em away. Yeah, I'm not gonna die today. Yeah, I'll live to see another day. There are different kinds of mimics, kinds of mimics. Batesian, Mullerian, Mullerian, Wasmanian, and Aggressive, Aggressive. They all help organisms to survive. I'm a Batesian mimic; I'm scaring them away, they won't mess with me today. I've evolved to look like I resemble a toxic guy. Aposomatic is how I get by; my colors gonna keep 'em away. Yeah, I'm not gonna die today. Yeah, I'll live to see another day."

Species video. Gray Squirrel**:** "As my name suggests, usually I'm gray, but sometimes in urban habitats I have a brownish tint. Ten inches is my height, and my tail is just as long. My residence is up in trees, which they call a drey, and when I head to the ground, I can do so facing down; all I have to do is flip my back claws around. I'm not a fan of summer heat, and I don't need to hibernate. My predators mostly fly, but cats and dogs will chase. I'd be good at any sport since I'm so fast and agile, Eastern Grey Squirrel, I'm in the Northeast temperate forests, scattering and hoarding, dispersing nuts and seeds, munching on berries and buds. I call the Sqiuirdae (sic) family mine, you will find me flicking my tail which helps me communicate; catch me if you can! Breeding twice a year from December to February and May to June, unless it's in the northern latitudes. The males will duel for the female's favors, but she may also mate with other squirrels, so these squirrels ain't loyal. I can live in the wild for up to 12 years but in a captive environment that number jumps to 20. Eastern Gray Squirrel, I'm in the Northeast temperate forests scattering and hoarding, dispersing nuts and seeds, munching on berries and buds. I call the Sqiuirdae (sic) family mine. You will find me flicking my tail, which helps me communicate; catch me if you can! All across the North American East, in temperate forests lives this beast; woodlands dense with trees and nuts are where they're happiest to keep their furry butts. Think hardwoods, ones with mast, like oaks and hickories for habitat that lasts. The need to feed is satisfied with seeds, berries, flowers, bark, and buds, as well as the occasional fungus, bulb, and bug. Scatter hoarding is the name, for they're saving food for later game. They hide their food in little caches, scattered about in random patches. Eastern Gray Squirrel, I'm in the Northeast temperate forests scattering and hoarding, dispersing nuts and seeds, munching on berries and buds. I call the Sqiuirdae (sic) family mine. You will find me flicking my tail, which helps me communicate; catch me if you can!"

Habitat video. Coastal Plain forests**: "**I'm in love with the eco. I'm in love with the eco. The Georgia coast got a lot, though, disappearing due to people. Starting off with the moist slope where the sweet magnolia is home. Most popular ornamental, 12 varieties on the globe. Sweet magnolia does not live solo, to survive needs well-drained soil. Found where the plain is coastal, moisture is what's focal. Pocosins the next eco. They contain acidic soil; oligotrophic is what we call this eco, can be found at high sea level. Between streams is where they go, perched water levels reside below. Carnivorous plants call this home. Pocosins often drained by people. I'm in love with the eco. I'm in love with the eco. The Georgia coast got a lot though. Disappearing due to people. Sandhill, that's my favorite eco, where loblolly pines hold the throne. Widely cultivated for the pulp. Longleaf pine quick to inferno, preventative fires for protection. Uplands massively affected by people. Severely reduced longleaf pine zone, 98 million acres are gone. Habitat for the snake that is indigo, title of longest snake is what it holds. Signing out with the Bayhead eco. Broadleaf evergreens call this home. Sweetbay

magnolias it is commonly known. Used in parks because it's ornamental. Borders of the swamp is where red bays assemble. Its purposes are not medicinal; used in cooking because it's tasteful. Species under attack by a beetle, to the red bay it is lethal. Invasive species that is oriental, the sale of wood is deceitful, because it causes the spread of the beetle."

Questionnaire Responses

The study group was composed of 64 percent (N = 54) first and second year students, whereas 36 percent (N = 31) were in their third year or higher (remainder, no report). Students' majors or proposed majors were heavily slanted to non-science topics, with 89 (N = 76) percent reporting non-science and 11 (N = 9) percent reporting a science major. More specifically, majors were distributed as follows: Life Sciences 10% (N = 8), Business/Engineering 46% (N = 39), Journalism/Policy 25% (N = 21), Family/Consumer Science 4% (N = 3), and Education 15% (N = 13). The musical experience of students varied, with 33 percent (N = 28) reporting high musical skills/experience (song writing, performing, singing, and memorize songs), 48 percent (N = 41) reporting average musical skills/experience (listen to music regularly, can sing a few songs), and 19 percent (N = 16) reporting low musical skills/experience (don't sing or memorize songs or experience non-existent).

The overwhelming response of students to the Karaoke Video project was positive, with 75% of participants agreeing that the video project enriched their class experience and 83% responding that the project aided in learning class material (Table 1). Students also reported that their groups functioned well (92%), even without supervision by an instructor or teaching assistant, and that participating in a group project enhanced their class experience (78). Surprisingly, 22 percent of students expressed a preference for an extra exam over the video project (Table 1). Overall, positive student responses to questions were significantly more common than negative responses ($t = 14.49$, $d.f. = 14$, $p << 0.0001$).

Table 2
Analyses Testing the Hypothesis that Musical Ability Affected Student Perceptions of the Karaoke Video Project

	Positive Response			Negative Response		
Question	High/good musical Ability %	Average Musical Ability %	Low/Non Existent Musical Ability %	High/good musical Ability, %	Average Musical Ability %	Low/Non-Existent Musical Ability %
1. Making the karaoke video enriched my experience in class.	79	71	81	21	29	19
2. I didn't understand the purpose of the video assignment.	36	32	25	64	68	75
3. The video helped me learn material.	89	76	88	11	24	12
4. I prefer an additional exam rather than the video assignment.	14	27	25	86	73	75
5. My group functioned well, and work was evenly distributed.	89	93	94	11	7	6
6. Making the video was a waste of my time.	18	20	12	82	80	88
7. My video experience would have been more positive if the groups were supervised by a TA or instructor.	18	17	25	82	83	75
8. Having a group project enhanced my experience in class.	75	76	75	25	24	25

Note. Student groups were high musical ability, good musical ability (n = 28), average musical ability (n = 41), low musical ability (n= 16). Data are percentages.

Table 3
Student Responses Regarding Their Favorite Aspect of The Karaoke Video Making Process for the Study Group and the Group Partitioned by Various Characteristics

Comparison	n	Writing Music %	Writing Lyrics %	Singing Lyrics %	Researching Material %	Technical production %
Study Group	85	11	35	18	14	22
High (A/B) course grade	81	10	37	17	14	22
Low (C or lower) course grade	4	25	0	25	25	25
First/second year	54	7	43	14	16	20
Third year or higher	31	15	45	10	10	20
High attendance	82	11	35	17	13	23
Low attendance	3	0	33	33	33	0
High/good musical ability	28	7	36	39	7	11
Average musical ability	41	10	29	7	20	34
Low musical ability	16	19	50	6	13	12
Correctly reported highest exam grade	46	13	33	15	17	22
Incorrectly reported highest exam grade	35	8	34	23	9	26

Note. Students who received a course grade of A and B versus those who received a C or below, students who were in their first or second years at university versus those in their third year or higher, etc. Data are percentages and n = 85.

Students' musical abilities or experience did not strongly affect their responses to the video project, because positive responses did not differ significantly among the three levels of musical experience (Table 2, ANOVA F = 0.53, p = 0.60, positive responses). Nor were there significant differences in students' preferences for an aspect of the karaoke project (e.g., writing lyrics, writing music, singing, researching material or technical production, ANOVA F = 0.004, p = 0.99, Table 3). The same was true for students who correctly reported their highest test score on the questionnaire versus those who reported a higher score (Table 4, t = -0.85, d.f. = 10, p = 0.40, for positive responses), and these two groups also did not display significant differences in their preferences for different aspects of the karaoke project (Table 3, t = 0.10, p = 0.92.). Finally, students' year in school also did not significantly affect their positive responses to questions (Table 5, t = -0.55, d.f. = 14, p = 0.59).

Triangulation Interviews

The following are complete sets of responses for the four undergraduates and three graduate students who completed interviews:

1) How was your learning affected by the Karaoke Video project?

Undergrad 1: Karaoke Video project was our final, so I guess what it did was it asked the class to take a specific concept and go in depth about that concept a little bit more, but it did create a little more stress because it was the final project. I thought the project was an interesting take on learning new material, but at the same time it was almost like something I'd be asked to do in high school.

Table 4
Analyses Testing the Hypothesis That Students Who Correctly Reported Their Highest Test Score Did Not Differ in Their Responses to the Karaoke Video Questionnaire Than Students Who Correctly Reported Their Highest Test Score

	Positive Response		Negative Response	
Question	Grade Correctly Reported %	Grade Incorrectly Reported %	Grade Correctly Reported %	Grade Incorrectly Reported %
1. Making the karaoke video enriched my experience in class.	76	71	24	29
2. I didn't understand the purpose of the video assignment.	33	31	67	69
3. The video helped me learn material.	78	86	22	14
4. I prefer an additional exam rather than the video assignment.	28	14	72	86
5. My group functioned well and work was evenly distributed.	91	91	9	9
6. Making the video was a waste of my time.	20	14	80	86
7. My video experience would have been more positive if the groups were supervised by a TA or instructor.	15	23	85	77
8. Having a group project enhanced my experience in class.	74	83	26	17

Undergrad 2: Sure, I learned a lot about owls and other things. I think some of the other group's videos were pretty good. The groups whose videos were based on concepts were more effective than videos that were based on an animal in particular.

Undergrad 3: I would say it was positively affected with regards to the specific topic that we did our project on. The video helped me really learn and commit to memory specific facts and stuff about our topic, which was bobcats. The video really helped me remember specific things about the bobcat and actually know the material instead of cramming it in the day before a test.

Undergrad 4: I think that I got to be a lot more in depth on a particular subject as opposed to the class which covered a lot of broad material which makes it hard to learn a lot about a particular subject that you're interested in. So I feel like I benefitted from learning as much as I could about a particular subject.

Graduate student 1: The video helped reiterate the basics of the ecology of the fish species I used in my video, but it was information I already knew, so the effect wasn't too profound. I think the effect of the exercise would have been different if I had to do a video on material I didn't already know; then I could see how the exercise could be helpful in learning new material, but since I already knew the basics of the fish's ecology I don't think I really learned any differently.

Graduate student 2: The information and material I used for the karaoke project was already part of my previous research, so I wasn't learning material fresh. I just incorporated what I had already learned previously.

Graduate student 3: Well, I'm not musically inclined, so I was nervous making the video, but once I got past my nerves and anxiousness about the project I could see how making the videos helps you retain material. I mean, in my video I used material I already knew, but I could still see how the process helps.

2) Were there specific aspects of making the video that aided your learning?

Table 5
Analyses Testing the Hypothesis That Students in Their First or Second Year of School Did Not Differ in Their Responses To The Karaoke Video Questionnaire Than Students in Their Third Year, Fourth or Fifth Year

	Positive Response		Negative Response	
Question	1st & 2nd year %	3rd year+ %	1st & 2nd year %	3rd year+ %
1. Making the karaoke video enriched my experience in class.	74	77	26	23
2. I didn't understand the purpose of the video assignment.	33	29	67	71
3. The video helped me learn material.	81	84	19	16
4. I prefer an additional exam rather than the video assignment.	24	19	76	81
5. My group functioned well and work was evenly distributed.	91	94	9	6
6. Making the video was a waste of my time.	19	16	81	84
7. My video experience would have been more positive if the groups were supervised by a TA or instructor.	20	16	80	84
8. Having a group project enhanced my experience in class.	81	73	19	27

Undergrad 1: Learning the material to make the lyrics made me think about what I learned, and then putting what I learned into words and into a song made me think about the material more.

Undergrad 2: I think the most helpful aspect of the project for learning was doing the research and writing the lyrics.

Undergrad 3: Writing the lyrics probably helped me the most just because that was my main part of the video; I wrote all the lyrics. I also helped sing, but just writing the lyrics helped me learn the most because you're looking at the notes and trying to figure out what will work with what tune or rhyme, and you're just reviewing your notes without thinking about it.

Undergrad 4: I think having to make the actual videos made me spend a lot of time with the lyrics we wrote, and I had to double-check a couple of times to make sure we were getting the information right, so I think the repetition was what was most beneficial.

Graduate student 1: Creating the lyrics.

Graduate student 2: I learned the basics of audio editing and video editing, and I enjoyed that process. I enjoyed getting a glimpse of that kind of software. I think any time that you incorporate new information into a project where you not only read it but also identify main points and items about the material, I think that really helps you learn the material better.

3) What do you think the purpose of the video assignment was?

Undergrad 1: The video was a new way of testing students on what they got out of the class, what their favorite part of the class was, and then taking that and turning it into something that everyone could appreciate.

Undergrad 2: I think the purpose of the assignment was to take the knowledge we had learned throughout the semester and have it culminate in one project where students were allowed to take something that they were interested in and learn

more about it and then to use those videos and allow other students to learn as well.

Undergrad 3: In addition to learning a specific topic from the class, I think it was to have students think about the positive effects that putting information to song form can have on helping you learn material.

Undergrad 4: I think the purpose was for us to think in a different way than we normally do when we learn new material and to strengthen critical thinking of the class. I also think the assignment gave us the opportunity to learn about something in the class that we're kind of interested in.

Graduate student 1: To help us think outside the box and to help us come up with ways to learn and remember fish ecology.

Graduate student 2: I think the assignment was an experiment in trying to teach material in a different and new way, and I think it would be a good project for future teachers.

4) Should anything be changed about the video project?

Undergrad 1: Nothing much, maybe a little more guidance on what the videos should be like. We had seen Dr. Grossman's videos, but until the day we saw everyone's videos we had no idea what to expect as far as a good vs. a bad video. Maybe if he showed us an example of the type of video he wants that would help.

Undergrad 2: No response.

Undergrad 3: Not really but maybe instead of having it as a big project you could have it as a couple of small assignments where students just make the lyrics instead of doing the whole video.

Undergrad 4: I think it would be helpful if Dr. Grossman were to be more involved in us making the project because it was hard to make the video without a lot of guidance from him.

Graduate student 1: Even though I liked being able to pick our own topic, I think we should be assigned a subject we don't know as much about.

Graduate student 2: I thought the exercise was decent. I think the exercise would be more effective as far as a learning technique if we had been required to research material I didn't already know, but it was convenient to be able to use information I already had.

5) How was working in a group beneficial to your learning experience, and how was it detrimental?

Undergrad 1: Normally I'm not one for group work, but in this case group work was definitely helpful because I'm not much of a creative person, and being able to bounce ideas off people who were more creative than I was definitely helped to get content into a form that was useful to other people.

Undergrad 2: If I would have been able to pick my group that would have been more beneficial, but because the groups were randomly assigned I didn't know the two guys I was working with, and one person never showed up or contacted me. One of the guys in our group would always argue at the meetings or try to get us off track, which kept us from being productive. It ended up being just me and this other guy where I did the research and wrote the lyrics and he handled all the technical aspects. So I felt that I got the wrong end of the deal in the sense that I didn't know the two guys in my group wouldn't contribute and I was stuck with them.

Undergrad 3: I'd say it was neutral. It didn't really positively or negatively affect me; it was just that group projects can sometimes be a pain, but it didn't cause me to be worse off. I guess it was more beneficial because if you were working by yourself, a lot of people wouldn't want to sing in their own music video, so having other people there takes a lot of weight off your shoulders when it comes to the singing aspect.

Undergrad 4: Personally my group was really awesome and everyone worked well together, so the group worked well for me. But I've had bad group experiences, and I know people in the class that had bad group experiences with the karaoke project, but I also think that when you divide the work with people that you don't know, some members of the group just tend to get more work done than others. So maybe Dr. Grossman could consider letting us have a say in who was in our group; that would help everyone.

6) Do you have any other comments on the Karaoke Video project?

Undergrad 1: I know before I turned the video in I was thinking I would have rather taken a paper final, but once I finally did the video and we presented the video I felt pretty good about what I had done.

Undergrad 2: I think it was very unique. It was something I didn't expect to be in a college level course, but I think it was good because it was better than having to study for a test or write a paper because it allowed us to use our creativeness and make something that the professor could use later on. I feel like since I've been in college I've never had an assignment like this, so that may be why I associate the assignment more with high school. I do think it's good to throw away the idea giving only tests and papers and allow students to use their more creative side.

Undergrad 3: No, I don't think so.

Undergrad 4: I liked it, and I think that it helped my grade to have the project as the final because I'm not good at taking tests, but I'm good at learning information through projects so I liked it.

Graduate Student 1: I thought it was fun, but I thought for a graduate class it felt a lot like busy work. The assignment took a lot of time, and at the time I didn't have much time to spare. It was a fun and interesting activity, and I could see how it would be helpful for an undergraduate class, but I think it's too much of a busy task for a grad class.

7. How did seeing your video in class make you feel? [Names were removed from videos before they were shown in class.]

Undergrad 1**:** I'm not much of an optimistic person, so I was like, man, this video isn't as good as other people's, because other peoples are way better, but as the other videos played you realized that they were all meant to be fun and convey some sort of information to the audience.

Undergrad 2: Seeing my video was fine. Our names weren't on the video, so no one really knew it was me, but other people could have been embarrassed. There was one guy who was really good at singing, and everyone was clapping afterwards, so that was kind of funny.

Undergrad 3: I didn't really care; everybody is kind of in the same boat, so it's not a big deal. I could see how some people could get embarrassed, but it's not like there's a picture of your face up there with the video.

Undergrad 4: It was fine. I thought it was interesting to see other people's videos. I didn't know that some people had done the same topic, so it was interesting to see how some people had interpreted their topic differently.

Responses to triangulation interview questions raised additional specifics about the project and also confirmed the strong positive student responses documented by the questionnaire. Students clearly understood the innovative nature of the project, and their comments indicate that they did use higher-order cognitive processes (analyzing, applying, synthesizing, and creating) in construction of the video.

Discussion

Student responses to the Karaoke Video project were strongly positive for both undergraduate and graduate classes, and the project clearly created positive class atmospheres and invoked higher-level cognitive processes. For the natural history class, particularly salient findings were the lack of significant differences between students with different 1) levels of musical experience, 2) rank in school, and 3) accuracy in grade reporting (i.e., differential bias in self-reporting). Such findings are noteworthy because there are few active learning exercises for large, undergraduate introductory natural history, zoology, or ecology classes that typically possess heterogeneous student populations. This is particularly true for classes designed for non-science majors that meet undergraduate general education or other requirements. Nonetheless, questionnaires indicated that a small percentage of students (8%) in the natural history class did not have a positive group experience, and this opinion was echoed by one student's triangulation interview. Students were assigned to groups randomly, with the proviso that each group had one student who earned an A on the first exam, to decrease the variability in groups that would inevitably have been present if students had been allowed to choose their own group members. Self-selection in groups likely would have resulted in groups based on social relationships or intellectual ability rather than groups that were representative of the spectrum of relationships/abilities present in the class. Consequently, we believe random selection of group members was the best method for obtaining the most representative groups, because it should have minimized the differential intellectual, musical, and technological abilities within groups, in addition to helping students gain experience in working with new

people. Students also would have benefitted by being shown sample videos, but given that this was our first attempt at the project, we had no examples; this will be remedied in future classes. A few students also gave mixed responses regarding the "intellectual" level of the project, stating that it reminded them of high school (undergraduates) or undergraduate activities (graduate students), but these comments usually were combined with statements indicating that significant analytical, synthetic, and creative efforts were being expended in completion of the project. Finally, graduate students commented that they wanted to research something other than their thesis topic, and in future classes we will restrict the project to new topics alone. Nonetheless, graduate students were free to choose any relevant topic they wished; hence, their dissatisfaction was a consequence of their own decision to focus on material they already knew. This probably was a strategy to minimize the effort needed to meet class requirements. A minor shortcoming of the Karaoke Video exercise is that it was impossible to have students do more than one video; hence, although they clearly found the experience valuable, the information gained by creating the video represented only a small portion of the total class content.

In completing the Karaoke Video project, students used multiple faculties on the high end of Bloom's taxonomy of knowledge (Krathwohl, 2002), including gathering, applying, analyzing, evaluating, and creating information for a three to four minute video that captured the most important aspects of a habitat, a species' biology, or an ecological or evolutionary concept. Thus, there should be greater retention of the knowledge obtained via the project. Evaluation of the actual effect of the project on learning and retention was beyond our resources; indeed, even with adequate funding it would be difficult because of the individualized nature of the projects (few students made videos on the same topic). This would require developing myriad pre- and post-exposure quizzes, and creation of a realistic control also would be difficult. In addition to engaging higher level intellectual faculties, based on their affects, students clearly enjoyed watching the videos during the final class session. The fact that students knew that their videos would be shown in class may well have served as a partial censor, ensuring the appropriateness of the material.

Not all students liked the Karaoke Video project, and we were surprised by the substantial number of undergraduates (22%) who would have preferred an exam in its place. The karaoke project clearly took these students out of their comfort zone and perhaps required more work than they were willing to expend in class. Undoubtedly, the innovative nature of active learning assignments may confuse and even anger some students unfamiliar with this pedagogical approach. In addition, although responses were overwhelmingly positive, the data were self-reported and may have included an element of bias. Questionnaires were not anonymous; otherwise, it would have been impossible to test for effects such as year in school or self-reporting bias. Nonetheless, the lack of significant differences between students who correctly and incorrectly reported their highest test score suggests that potential self-reporting biases were not strong. In addition, self-reporting is most biased when dealing with personal health issues or negative behaviors such as cheating, smoking/drug use, or food consumption (Huang, Almeida, & Roberts, 2012; Nath, 2007) and probably less biased when dealing with class projects like the karaoke video.

The Karaoke Video project was not without logistical complications, the most substantial being the difficulty of obtaining videos of animals behaving naturally. All of the videos provided to students depicted animals; nonetheless, because of logistical constraints it was necessary to shoot them the summer before class using a student assistant. Due to the unpredictability of weather and wild animals, it would have been very difficult for an instructor or TA to obtain quality video during the semester. Regardless, students were able to obtain video from the internet and lecture slides (text and image slides and video links), although typically this involved video on concepts or habitats. We are not sure that any student shot their own animal video, despite the ubiquity of video cameras on cellular phones. Additionally, few students responded to my requests for triangulation interviews, which occurred two months after the conclusion of the semester. Perhaps too much time had elapsed and at that point students were concerned with issues in other classes. Nonetheless, all of these problems can be solved with good planning and financial resources; in no way do they suggest that the exercise is too difficult for an instructor to undertake.

An additional benefit of the Karaoke Video project was that it involved music, which has been shown to be a positive motivational force for students in both science and non-science classes (Crowther, 2012; Crowther & Davis 2013; Governor, Hall, & Jackson, 2013; Grossman & Watson, 2015: Iverson & James, 2011). The senior author has previously written and performed in music videos depicting conceptual, habitat, and species information for earlier Natural History of Georgia classes, and these videos improved student perceptions towards many aspects of class as well as aiding in their learning (Grossman & Watson, 2015). It is possible that the strong positive reactions to the instructor's music videos were affected by the fact that students enjoyed seeing and hearing their instructor play an instrument and sing. In part, this was an

impetus for developing student-based, active learning music videos.

Our conclusions regarding the positive effects of active learning are supported by a recent meta-analysis of over 200 studies comparing active to passive learning modes in undergraduate STEM classes (including biology). Freeman and colleagues (2014) found that active learning increased performance on exams and concept inventories by one-half a standard deviation and decreased failure rates by 55%. These effects were substantial across class sizes from large (> 110) through medium (50-110) to average (< 50), but not surprisingly they were most pronounced at class sizes smaller than 50 (Freeman et al., 2014). Freeman and colleagues (2014) tested for various aspects of study bias including non-equivalence of instructors and subjects and found these potential biases had no effect on their findings. In closing, we would urge instructors teaching large introductory biological sciences or resource management courses to consider using the karaoke project as an active learning exercise. Besides its incorporation of higher-order cognitive faculties, it is a project that is likely to be enjoyed by most students regardless of discipline or academic rank.

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Appendix
Karaoke Video Rubric

The purpose of the karaoke video assignment is to give you a creative outlet for learning and presenting class materials. The topic of the video may be on a particular habitat type, a concept such as predation or habitat selection, or a species. The video should be between 3-4 minutes long, and it will be graded on creativity and accuracy. Specifically, the 60 possible points will be divided as follows: scientific accuracy – 25 points, creativity – 20 points, technical quality– 15 points. The video should consist of images relevant to the subject with text superimposed on the bottom of the screen, or you may just have a few images with the remainder of the video being the written lyrics of the song. Regardless, the video should be constructed so the class can sing the lyrics. The sound track should consist of whatever music you choose (or you can sing acapella) with the group singing the lyrics. You may create your own video or use video already on eLC or Youtube that you download, but it must be relevant to the topic. Here is a discussion of how to download Youtube videos: www.digitaltrends.com/computing/how-to-download-youtube-videos/ . However, be careful about downloading free programs: sometimes they come with "Trojan programs" such as browser hijackers. Because your video is for educational purposes, you do not have to worry about copyright issues, but if you decide to use it out of class, it will be subject to copyright violations if someone else holds the copyright. Most smartphones have video capability as well as a built-in microphone, as do most laptops. Most laptop/netbook computers also have video editing software such as Windows Movie Maker. If you need help, contact the professor. The final video should look like one of the class music videos which are on eLC. The only original portions of the video you will be required to provide are the lyrics and the singing of the lyrics on the video. Not everyone in the group has to sing, but don't put it all on one member. Because this is a group project, everyone in the group will provide an anonymous rating of the contributions of every individual in the group. A useful reference on making short videos is www.slowmation.com/ .