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Promoting student learning by having college students participate in an online environment

Celia C. Lo[1], Ebony Johnson[2], and Kimberly Tenorio[3]

Abstract: Using data collected in spring 2009 from students at a southern research university enrolled in either of 2 sections of a general education course that fulfilled a social/behavioral sciences graduation requirement, the present study examined whether participating in online assignments enhanced students' satisfaction with those assignments and with their learning. Online assignments included chapter exams, video questions, and survey questions; they were due weekly. Additional online assignments were 2 threaded discussions over the semester. The study used subjective and objective measures of student learning. Overall results confirmed that having students participate in online assignments can promote student satisfaction and foster critical thinking and deep learning. Practice implications are briefly discussed.

Keywords: online assignments, general education course, student learning, student satisfaction

I. Introduction.

Student learning is a social construct that Schneider has argued is grounded in a 21st-century reinvention of the liberal educational ideal. That reinvented ideal calls for cultivating "intellectual judgment, social responsibility, and integrative learning" (2003, p. 3). Pursuing the ideal requires faculty to foster students' analytical capability through work on their critical thinking, problem solving, and application skills; by involving students with people from various cultural backgrounds in intercultural and community contexts; and through creation of structured opportunities to integrate knowledge from numerous disciplines and link theory to practice (Schneider, 2003).

A general education course, Analysis of Social Problems, was completely redesigned, yielding a hybrid course in which both online resources and classroom-based collaborative learning activities were used to improve active learning and critical thinking (Garrison & Kanuka, 2004; Rovai & Jordan, 2004). In the hybrid course, moreover, emphasis was placed on learning processes as opposed to teaching processes; the learning environment was one in which evidence-based learning activities were used to move students gradually toward thinking critically (Bullen, 1998). Using data from students in two sections of the course in spring 2009, the present study examined whether and how online assignments given to these students were related to student learning. The study hypothesized that students' regular participation in developing answers to questions and solutions to problems in an online environment would be associated with attitudes relatively favorable to the assignments, which in turn would improve student learning.

[1] Department of Criminal Justice, University of Alabama, Tuscaloosa, AL 35487-0320, clo@ua.edu.
[2] Department of Educational Studies in Psychology, Research Methodology and Counseling, University of Alabama, Tuscaloosa, AL 35487-0320, johns362@crimson.ua.edu
[3] Department of Criminology and Criminal Justice, University of Maryland, College Park, MD 20742, ktenorio@umd.edu

Active learning refers to cultivation of knowledge via the learner's involvement in knowledge construction, within a learner-centered learning environment (Blumberg, 2009; Carlson & Schodt, 1995; Chermak & Weiss, 1999; Garfield, 1995; Karagiorgi & Symeou, 2005; Rockell, 2009). Knowledge obtained in this way is often called *deep learning* and includes both content mastery and skill development; normally it is more flexible and is retained longer than knowledge from *passive learning* or *surface learning*, both terms describing learning dependent on one-way passage of information from instructor to learner, the learner undertaking little processing of information offered (Jones, 2006).

Active learning clearly reflects Dewey's reflective thinking and interchangeable contemporary terminologies like critical thinking, problem solving, and high-order thinking (Samuel, 1999). Jacobs and colleagues define critical thinking as "the repeated examination of problems, questions, issues and situations by comparing, simplifying and synthesizing information in an analytical, deliberative, evaluative, decisive way" (Jacobs, Ott, Sullivan, Ultrich, & Short, 1997, p. 20). Grouping skills like problem solving, application, and integration under the umbrella of critical thinking, many researchers and educators argue the importance of sharpening students' thinking skills, such that critical thinking has become the primary goal for students in institutions of higher education (Anderson & Garrison, 1995).

Development of critical thinking can be pursued in various classroom or online settings, given the careful inclusion of social-environmental designs conducive to learning (Hannafin & Land, 1997). Today many students belong to the so-called Millennial generation. They are technologically savvy, are comfortable learning by trial and error, and want to stay "connected"; for them, computer-assisted assignments provide a reasonable context for learning (Meyer, 2003b; Oblinger, 2003; Rovai, 2004; Rovai & Jordan, 2004). Evaluating online learning environments in terms of their *cognitive presence, social presence,* and *teaching presence,* Garrison, Anderson, and Archer (2001) developed a conceptual model positing that deep, meaningful learning happens when the degree of each presence is sufficiently high. High cognitive presence can be achieved by having students (*a*) engage in reflective thinking and (*b*) make critical inquiries—via discussion with peers and teachers—in order to obtain meaning and construct knowledge (Garrison, et al., 2001). High social presence is indicated by a supportive learning environment in which all students are comfortable expressing their ideas. High teaching presence depends on the appropriate organization, structuring, and design of the learning environment to enhance student learning (Anderson, 2008).

In online settings, students, teachers, course designers, and computer technicians all contribute to the creation of the environmental conditions necessary for learning. Teachers, however, are arguably most responsible for building cognitive presence, social presence, and teaching presence into the learning environment (Barkley, Cross, & Major, 2005; Berling, 1998; Smith & MacGregor, 2000; Umbach & Wawrzynski, 2005). Results of several empirical studies have confirmed the relationships, in online settings, among these 3 presences and the development of critical thinking (Bullen, 1998; Garrison & Cleveland-Innes, 2005; Gunawardena & Zittle, 1997; Richardson & Swan, 2003; Rovai, 2004). Research has also documented that an online experience serves as a mediating factor in student satisfaction, channeling the effects of cognitive presence, social presence, and teaching presence on student learning (Arbaugh, 2001; Hiltx, 1993; Rodriquez, Plax, & Kearney, 1996).

The aim of the present study was to relate students' participation in online assignments to student satisfaction and student learning. With data from the students taking the redesigned, hybrid course, we could assess whether student learning increased when students participated in

online assignments designed to stimulate their construction of knowledge. The next section describes the hybrid course and details the online assignments used.

II. Research Context.

Taking a constructivist approach to learning and informed by the 21st-century notion of the liberal education ideal, we designed a hybrid version of a 200-level sociology course, Analysis of Social Problems, so that it was part traditional classroom, part online. This general education course was offered in spring 2009 at a southern research university and aimed to increase cognitive presence, teaching presence, and social presence in order to enhance learning. To produce the 3 presences, several steps were taken (Lo & Olin, 2009). Students were encouraged to take responsibility for learning, and the instructor assumed a role of teacher-facilitator (Association of American Colleges and Universities, 2002). Various learning and assessment methods were used, with both in-class and online activities used as vehicles of active and collaborative student learning. Assignments were framed to elicit critical thinking, including problem solving, application of knowledge, and integration of materials. The instructor encouraged shared, lateral communication among students, both in the classroom and outside it (Scarboro, 2004). The various outcome assessments for the course yielded results which encouraged confidence that, by semester's end, the students would gain both knowledge and the desired capacity for critical thinking.

The course blended the advantages of strictly online and strictly face-to-face learning, exploiting evidence-based pedagogical techniques to strengthen student learning (Spinello & Fischbach, 2008). The first of these techniques was minimization or actual elimination of formal lectures (Greek, 1995; Halpern & Hakel, 2003; Schneider & Shoenberg, 1998; Shen, Hiltz, & Bieber, 2008). The lectures dropped from the course syllabus were replaced with a lateral-exchange, question-and-answer format through which information could be shared among students and instructor. Students were assigned substantial responsibility for the learning process; they became real agents of learning, involved directly in the construction of knowledge (Cohen, Lotan, & Leechor, 1989; Rau & Heyl, 1990). The second evidence-based technique, meant to promote students' understanding of course materials, was the effective use of certain collaborative activities endorsed by the literature (Benbunan-Fich & Hiltz, 2003; Gokhale, 1995; Johnson, Johnson, & Smith, 1991; Jones, 2006; McKeachie, Pintrich, Lin, & Smith, 1986; Rau & Heyl, 1990).

The third technique was the development of questions and problems to assign as online work providing practice in the application of theories and concepts to new situations. These questions and problems were particularly carefully thought out; in writing corresponding answers and solutions, students needed to spend time reflecting, equipping themselves to assess evidence adequately, making inferences, and selecting appropriate strategies to apply (Bullen, 1998; Norris & Ennis, 1989).

The fourth technique comprised conveying clearly to the students the expectations about learning. Several channels were used: a detailed syllabus, well-defined purposes and procedures for classroom activities, a grading rubric for assignments, and frequent oral and online communication between students and instructor (Stevens & Levi, 2005; Suskie, 2004). The fifth technique was varying the course assignments and assessments, acknowledging students' various learning styles and backgrounds in order to more accurately measure their achievement (Crowe, Dirks, & Wenderoth, 2008). The sixth technique was making students accountable to themselves,

to the members of their activity groups, and finally to all enrolled students and the instructor herself, together as a class; this accountability was secured, in part, through students' participation in evaluations (Angelo & Cross, 1993; Halpern & Hakel, 2003; Nilson, 2003).

Again, all 6 techniques underpinned the redesigned Analysis of Social Problems course, which involved both online and in-class assignments and activities requiring collaboration with others as well as reflective thinking supporting the solution of problems, application of theories, and development of policy implications. The hybrid course was assigned 3 credit hours. Students met face-to-face once a week for 75 minutes, joining in group and class discussions. Except for these classroom activities, all work was completed via eLearning, the digital course management system supported by Blackboard that creates a virtual environment for teaching and learning in educational settings. In the group and class discussions and online assignments, students were asked to link principles from sociological theory (and empirical findings supporting those principles) to real-life developments in the profession, seeking solutions to problems of practice. They were also advised to show they could integrate theoretical principles and relevant sociological literature into any assignment completed for the course.

The course, again, was structured to create an environment promoting student-centered, active, and collaborative learning. It was also designed to focus on a single social problem each week. Each week, the group and class discussions were scheduled several days ahead of the due date for that week's 3 online assignments—a survey assignment, a video assignment, and a chapter exam. This schedule was meant to ensure that discussions would help students as they completed online assignments. The weekly survey assignment normally included reading an article from a well-known magazine (e.g., *New York Times Magazine*, *Newsweek*) and answering a question the instructor had derived from it. The video assignment was to answer a question posed by the instructor based on a video students viewed; answers were to be drawn from the video as well. Questions based on the articles and videos were structured to prompt students to apply a theory or theories to a new situation, stimulating their integration of text materials with information from the videos and articles. Finally, each week's chapter exam, taken online, contained multiple-choice questions drawn randomly from a pool of questions about the week's textbook chapter. Augmenting the weekly assignments, twice during the semester a discussion question was posed to students, who were asked to compose at least one response to this question and one response to a classmate's response. Both discussion questions concerned a controversial issue, and heated debates arose during those class meetings. Because the assignments and activities took such wide-ranging formats (anything from a multiple-choice test, to making the case for interpreting a news video via a given sociological theory), a variety of learning channels were available to the class, accommodating students' diverse thinking paths and learning styles.

From the first day of the course, the students had access to all of their online assignments except the discussion questions and final exam. (The due date of each online assignment was also posted**.**) Such availability gave students ample time to reflect on content, fostering development of critical thinking skills. The weekly chapter exams were time-limited; once beginning a chapter exam online, a student had 1 hour to complete it. Students were informed in advance that once the hour had elapsed, the software would prevent further responses or changes. They were advised to complete exams as quickly as possible. The multiple-choice exams were graded automatically once answers were submitted. Other online assignments were graded by two graduate students trained to use the grading rubric available to students in the course syllabus. The grading rubric established clearly for students the instructors' expectations for assignments. Grading reflected mastery of content and also, at several points in the term, the

adequacy of student writing (grammatical and mechanical errors). Grades were normally assigned within 1 week of an assignment's submission, and students could review online all grades received during the semester. When grading was complete for an online assignment, sample answers for it were provided to students. The weekly assignments constituted frequent computer-based assessments—formative feedback—that should have helped students improve academic performance (Ricketts & Wilks, 2002).

III. Methods.

The study sample was college students enrolled during spring 2009 in a hybrid (classroom plus online) sociology course at a research university, a course that emphasized active and collaborative learning about social problems. Data were collected with a survey instrument completed via eLearning; students' grades on weekly online assignments during the semester and on the comprehensive final exam constituted other study data. At the end of the course, students were asked to complete an eLearning instrument surveying their satisfaction with the course and their perceptions about whatever learning the course prompted. Using these data, we analyzed relationships between students' participation in online assignments and student learning. The university's institutional review board had approved the conduct of the study. [A complementary study examining impact of classroom activities on student learning has been reported elsewhere (Lo, in press).]

Over the semester, 10 of the 124 students initially registered for the course withdrew, leaving 114 students in the present sample; each of the 114 received a final course grade. Of the 114, 40% were male and 45% reported pursuing a major in one of the social sciences, with some studying criminal justice and psychology. Most commonly, a student in the course was a freshman (roughly 4 of 10, or 41%), though 18% were sophomores, 27% were juniors, and 13% were seniors. Our research design did not involve collecting any other pre-course measures, for example GPA, or familiarity with online course work, or strength of critical thinking. This oversight makes somewhat uncertain our finding that participation in online assignments is linked to student learning and student satisfaction. The missing pre-course measures could perhaps have generated other variables explaining any link.

A. Measures.

Both objective and subjective measures were used to indicate student learning or academic achievement. Performance on the course's comprehensive, online final exam provided the objective measure. It posed 2 essay questions and 1 optional bonus question. They were intended to evaluate students' understanding of concepts and theories explored in the course and to gauge students' ability to apply these concepts and theories in new contexts. Grading of the final exam took into account the student's choice to attempt or decline the bonus question.

Perceived student learning was indicated by students' subjective perceptions of how useful a given instructional activity had been to their learning. Two questions measured subjective perceptions for each online assignment, the chapter exams, the survey questions, the video questions, and online discussions. Students were asked how effectively each of these had commanded their attention and how effectively each had prompted both deep thinking about the material and application of the material in other contexts. Response categories for the 2 questions were 1 (*not at all),* 2 (*to a small extent*), 3 (*to some extent*), 4 (*to a moderate extent*), 5 (*to a great*

extent), and 6 (*to a very great extent*). For each question, a higher-numbered response indicated greater learning perceived by the student.

We calculated a score for each student's participation in, and degree of accuracy in completing, each online assignment. This score was obtained by summing points awarded for the 14 chapter exams (7.5 points possible per exam), 14 video questions (6 points possible per question), 14 survey questions (6 points possible per question), and 2 discussions (12 points possible per discussion). Two measures of student satisfaction were used that allowed comparison of student satisfaction with online assignments to student satisfaction with take-home assignments like those in their traditional courses. Students were asked the extent to which assignments captured their interest and the extent to which assignments increased their deep thinking, versus traditional take-home assignments' capacity to increase it. Available responses were 1 (*Online assignments are worse than traditional assignments*), 2 (*Online assignments are slightly worse than traditional assignments*), 3 (*Online assignments and traditional assignments are similar*), 4 (*Online assignments are slightly better than traditional assignments*), and 5 (*Online assignments are better than traditional assignments*). For each question, a higher-numbered response indicated greater student satisfaction with online assignments.

IV. Results.

Simple statistics describing all variables included in the study are reflected in Table 1, which illustrates the high levels of student satisfaction and student learning characterizing this sample. The average grade of 93.7% on the final exam was very high; its objective measure was accompanied by 8 subjective measures, namely respondents' ratings of each online assignment. Each student in the sample reported that each assignment captured interest and increased deep thinking at least to some extent.

Compared to their rating for traditional course assignments, the sample rated online assignments high, on average, for the assignments' capacity to command attention (4.2 out of 5 possible) and increase deep thinking (4.13 out of 5 possible). The high numbers suggest students in the sample were highly satisfied with the use of online assignments in this course. The study measured student participation in each type of online assignment by summing the number of points each student was awarded for assignments across the semester, to obtain the following results on average: survey questions, 71.1 (out of 84 possible); video questions, 65.7 (out of 84 possible); chapter exams, 76.9 (out of 112.5 possible); and online discussions, 18.8 (out of 24 possible). These totals appear reasonable for a general education course.

Because strong correlations existed among the variables of participation in online assignments and among perceived learning linked to different online assignments, we used bivariate regression analyses to explain student learning. These were able to capture effects of each participation variable on each student satisfaction variable and student learning variable, at the same time suggesting the impact of student satisfaction on student learning. As Table 2 shows, each time students participated in an online assignment designed to develop problem solving and critical thinking, their final exam scores increased significantly.

As for subjective measures of student learning, we examined correspondences of (*a*) participation in a given assignment to (*b*) perceived learning linked by students to that same assignment. We observed that, when students participated actively or fully in responding to video questions, completing chapter exams, and pursuing online discussions, the ratings they assigned to these activities (reflecting the activities' capacity to capture interest and prompt deep

Table 1. Descriptive Statistics of All Included Variables.

Included Variables	Mean	S.D.	N
Student Learning			
Final Exam	93.69	9.31	110
Survey Questions Capture Attention	3.47	1.41	90
Survey Questions Increase Deep Thinking	3.65	1.43	90
Video Questions Capture Attention	4.20	1.29	90
Video Questions Increase Deep Thinking	4.07	1.34	90
Chapter Exams Capture Attention	4.38	1.27	90
Chapter Exams Increase Deep Thinking	3.97	1.37	90
Online Discussions Capture Attention	3.89	1.33	90
Online Discussions Increase Deep Thinking	3.74	1.34	90
Student Satisfaction			
Satisfied with Online Assignments' Capacity to Command Attention	4.20	0.99	90
Satisfied with Online Assignments' Capacity to Increase Deep Thinking	4.13	1.04	90
Participation in Online Assignments			
Final Scores for Survey Questions	71.11	13.61	114
Final Scores for Video Questions	65.71	18.71	114
Final Scores for Chapter Exams	76.92	16.99	114
Final Scores for Online Discussions	18.82	7.48	114

thinking) rose significantly (see Table 2). In contrast, no statistically significant results were found for the survey question about online assignments. While this study measured a high level of student satisfaction with online assignments generally, only two kinds of assignment—video questions and online discussions—generated significant increases in student satisfaction with online assignments' capacity to prompt deep thinking. Moreover, only video questions generated a significant effect on student satisfaction with online assignments' capacity to command their attention. The statistically significant relationship found between online discussions and student satisfaction indicates that interacting online—replying to and/or challenging classmates' answers—may enhance student satisfaction with online learning.

Table 3 presents measures for the 2 student satisfaction variables in relation to the objective *and* subjective measures of student learning. The data make clear that these variables' association with student learning was insignificant when student learning was measured objectively. In contrast, when student learning was measured subjectively, both variables did significantly affect student learning. Students rating the online assignments as better than traditional assignments at commanding attention and increasing deep thinking were relatively likely to report that all four assignment types captured their attention and increased their deep thinking.

Table 2. Bivariate Regression Results for Student Learning and Student Satisfaction.

	Participation in Online Assignments as a Predictor				
	Participation in Online Assignments				
Dependent Variables	Survey b coeff.	Video b coeff.	Exam b coeff.	Discussion	N
Student Learning					
Final Exam	0.19*	0.13**	0.16**	0.34**	110
Survey Questions Capture Attention	0.02				90
Survey Questions Increase Deep Thinking	0.02				90
Video Questions Capture Attention		0.02**			90
Video Questions Increase Deep Thinking		0.02*			90
Chapter Exams Capture Attention			0.03**		90
Chapter Exams Increase Deep Thinking			0.02*		90
Online Discussions Capture Attention				0.05**	90
Online Discussions Increase Deep Thinking				0.04*	90
Student Satisfaction					
Satisfied with Online Assignments' Capacity to Command Attention	0.01	0.02**	0.01	0.02	90
Satisfied with Online Assignments' Capacity to Increase Deep Thinking	0.01	0.02*	0.01	0.03*	90

* $p < .05$ ** $p < .01$

Table 3. Bivariate Regression Results for Student Learning — Student Satisfaction Variables as Predictors.

	Student Satisfaction Variables			
Dependent Variables	Satisfaction with Online Assignments' Capacity to Increase Deep Thinking			
	b Coeff.	N	b Coeff.	N
Student Learning				
Final Exam	-0.240	89	-0.780	89
Survey Questions Capture Attention	0.49**	90	0.43**	90
Survey Questions Increase Deep Thinking	0.51**	90	0.45**	90
Video Questions Capture Attention	0.46**	90	0.29*	90
Video Questions Increase Deep Thinking	0.5**	90	0.38**	90
Chapter Exams Capture Attention	0.41**	90	0.41**	90
Chapter Exams Increase Deep Thinking	0.58**	90	0.5**	90
Online Discussions Capture Attention	0.44**	90	0.43**	90
Online Discussions Increase Deep Thinking	0.38**	90	0.4**	90

* $p < .05$ ** $p < .01$

V. Discussion.

Using data collected from enrollees in 2 sections of a hybrid-format general education course offered in spring 2009, the present study examined whether having college students participate in online assignments enhances student satisfaction and student learning. The study also evaluated relationships between student satisfaction with online assignments and student learning. Several student learning variables measured both objectively and subjectively were used to indicate the enrollees' level of critical thinking. Overall, the study results confirmed that involving students in a series of online assignments can be important for increasing (*a*) their favorable attitudes toward online assignments versus traditional assignments and (*b*) degree of student learning, measured both objectively and subjectively. We used bivariate regression techniques in this study, examining relationships between student satisfaction, student learning, and participation in online assignments. However, there were no controls on pre-course measures that also could have explained student learning and student satisfaction. Future research should be sure to measure and control pre-course variables, employing multivariate data analysis techniques to better understand the relationships.

In the present study, student learning was indicated by an objective measure constructed to indicate students' critical thinking and by subjective measures of the extent to which enrollees' interest was captured and their deep thinking elicited. Mastery of a course's content is an important learning outcome, but development of high-order thinking is instrumental to students becoming lifelong learners and to their establishing personal criteria for their future ethical and intellectual judgments (Schneider, 2003). Having students participate in frequent work applying theories and concepts to novel questions and problems and/or requiring responses in essay format was shown in this study to be linked to higher achievement measured by a comprehensive final exam.

To supplement its objective measure of student learning, the present study used subjective measures indicating students' perceptions of whether given online assignments

actually piqued their interest to the point they undertook deep thinking. Students' perceptions about their reaching a deep-thinking stage may be affected, however, if critical thinking is too abstract a notion to be captured fully by objective measures. Consistent with previous studies, our results confirmed a relationship between student performance and online assignments, especially assignments accompanied by prompt formative assessment (Charman & Elmes, 1998; Sly & Rennie, 1999). In this study, three types of online assignment—video questions, chapter exams, and threaded discussions—were significantly associated with increased student learning, measured subjectively in students' perceptions. One type showed no such association—survey questions. The insignificant results obtained for survey questions may have arisen from a specific theme that characterized questions all semester: Hurricane Katrina. (The theme was chosen by the course instructor.) A typical survey question required responding to a magazine article. Specific topics of articles differed, but the presence of the Katrina theme throughout made some students comment that they felt they were writing on the same ideas repeatedly. It is possible, clearly, that lack of enthusiasm or lack of interest may affect students' interpretations of the learning achieved through an assignment.

Satisfaction measured among the present study's respondents was high, in terms of the use of online assignments instead of more traditional assignments. Their satisfaction, however, was not linked equally to all four types of engagement (i.e., with survey questions, with online questions, with threaded discussions, with chapter exams). It appears from the results that student participation in video questions and threaded discussions is most closely linked to satisfaction with online assignments. Any links between participation in survey questions or chapter exams and high student satisfaction were statistically insignificant. The literature reports that students' learning styles, personalities, and technological expertise are relevant to their success in an online environment (Meyer, 2003b; Rovai, 2004). Since college students today generally come from the Millennial generation, building a course around online assignments plays into their existing favorable attitudes about the online environment (Oblinger, 2003).

In this study, student satisfaction is thus partly a reflection of students' participation in online assignments; satisfaction was also observed here to be related to student learning, consistent with previous studies (Arbaugh, 2001; Hiltx, 1993; Rodriquez, et al., 1996). Significant predictive power of student satisfaction variables was limited, however, to those analyses involving our subjective measures of learning. Furthermore, the barely varying high scores on the final exam may have contributed somewhat to the objective measure's insignificant results, where student satisfaction variables also varied little. That we found quite significant results for perceived learning—measured *either* way—as an explanation of student satisfaction indicates the importance of having students participate in appropriate learning activities that stimulate interest and satisfaction, promoting critical thinking.

Instructors are responsible for creating the learning environment that cultivates problem solving and critical thinking, and doing so with shrinking resources. They must thus be knowledgeable of evidence-based pedagogical techniques capable of increasing teaching presence, social presence, and cognitive presence—while incurring little economic cost (Hannafin & Land, 1997). Their nature keeps hybrid courses cost-efficient, and using well-thought-out activities online can produce teaching presence, presence augmented by a hybrid course's simultaneous use of face-to-face learning (Dziuban & Moskal, 2001). And as the literature suggests, online study's minimization of the time factor enhances cognitive presence, freeing students to reflect, while its capacity to enhance social presence is seen in electronic

communication like threaded discussions, in which all participants have equitable roles (Garrison, et al., 2001; Meyer, 2003a; Picciano, 2002; Wise, Chang, Duffy, & Del Valle, 2004).

Several limitations on the study must be mentioned. First, its small sample precluded truly sophisticated multivariate data analyses that might elaborate on *how* being engaged in online work leads to student satisfaction and student learning. On the other hand, the rich data we collected describing student learning are a unique contribution. Second, the measures used in the present study were not the ideal for experimental study. For instance, while participation in online assignments could be usefully measured via students' total scores on online assignments, we did not compare said participation with the students' participation in traditional assignments. In addition, in drafting survey items used to measure subjective perceptions of learning and satisfaction with online assignments, we made the assumption that the surveyed students comprehended the concept *deep learning*. We do not know how well-founded this assumption was.

Third, our cross-sectional survey design may not be suitable for affirming temporal order, and for purposes of the study we assumed that participation in online assignments affected student satisfaction, which in turn stimulated student learning. Future studies should involve a true experimental study or a longitudinal design. They should furthermore move beyond theoretical affirmation of the three variables' relationships.

Finally, future studies should include factors such as existing knowledge, learning styles, and personalities—proven relevant to student learning among college students today—in order to further our understanding of student participation and student learning in higher education. All in all, the present study's results clearly confirm the contribution a carefully designed series of online assignments can make to students' satisfaction and learning in a general education course.

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Pre-service teachers' views: How did e-feedback through assessment facilitate their learning?

Ni Chang[1]

Abstract: This survey study was intended to explore whether or not students supported the way a university course instructor provided timely and detailed e-feedback directly onto their online assignments and how the e-feedback facilitated their learning. Twenty pre-service teachers, who had experienced the process, participated in the study. The data were analyzed quantitatively and qualitatively to answer the research questions. The findings indicate that the majority of students favored the instructor's provision of e-feedback. From their perspectives, the feedback was helpful, immediate, and convenient, allowing them to know whether they were "on the right track", encouraged them to think, enhanced their learning through reflections and corrections, and promoted their time management and writing skills. Implications of the study and suggestions for further research are provided at the conclusion of this report.

Keywords: e-feedback, student learning, assignments, instructor and student interaction

I. Introduction.

E-feedback is characterized as comments and responses that an instructor provides to students' written assignments or learning activities submitted via the Internet in the assessment process. In our contemporary technologically oriented society, the utilization of instant text messaging and omnipresent cell phones forms a habitual mindset that instant feedback is what students expect. However, the traditional methods of submitting and receiving feedback, e.g. in a face-to-face setting, may not satisfactorily meet the students' expectation. To allow quick feedback delivery to take place, many resort to electronic communication through various means, such as emails, course management systems (CMS), and the like. These allow teaching and learning to take place at 24 hours a day, 7 days a week, independent of location and learning style (Hong, 2002). However, in spite of the fact that the email system and CMS have the capability to convey feedback rapidly to meet the students' expectations, according to Hong (2002) and Young and Norgard (2006), there still exists online students' dissatisfaction with Web-based learning. For instance, based on the 2004 National Survey of Student Engagement (NSSE), almost 90% of faculty reported that they did provide prompt feedback to academic performance. But only less than 60% of the students agreed with the report. The disparity can be explained by the distinct perceptions held by the faculty members and students in viewing of "quickness" or timeframe in regard to offering feedback. The faculty members might respond the students' assignments faster than before thanks to the advancement of computer technology, but to the students (Generation

[1]Department of Elementary Education, Indiana University South Bend, 1700 Mishawaka Ave. South Bend, IN 46634, nchang@iusb.edu

Y), who are "technology savvy," do not see eye to eye on the issue. The discontent apparently converges on the instructors' delayed feedback (Hong, 2002; Young & Norgard, 2006).

Research has shown positive effects on students' learning as a result of immediate feedback. For example, Dennen, Darabi, and Smith (2007), Hong (2002), and Young and Norgard (2006) believed that prompt feedback could strengthen the active interaction between the instructor and student, which positively affected student learning. The student-instructor interaction via feedback allows for supporting students to gain knowledge and skills, which computers alone cannot make happen.

However, there is scant research reporting the justifications behind the students' preferences of the instructors' feedback. The present study, therefore, was intended to contribute to the emerging field of scholarship in the aforementioned areas by exploring students' perceptions of whether or not they liked the way online feedback was offered and of how the e-feedback assisted them in learning. The underlying research questions thus were, "Are students satisfied with the way the instructor provided feedback to their submitted online assignments?" And "How does feedback facilitate student learning?"

II. Literature Review.

A. Provision of Feedback through Assessment.

Currently, there is a growing demand from students for feedback on their performances (Siew, 2002) irrespective of an online or a face-to-face setting. In fact, current theory, research, and pedagogical standards have influenced the standards of teaching to include the need for students to receive feedback (Chang, 2009a, 2009b, 2009c; Chang & Pertersen, 2006). E-feedback works as individualized scaffolding and is what today's students increasingly need. Apart from the fact that students need more individualized support from instructors (Peat & Franklin, 2002), they also have higher expectations than before for the quality of feedback (Peat & Franklin, 2002). MacDonald and Twining (2992) suggested that students need not only the feedback that is immediate, but also the feedback that should effectively promote their learning, help them construct concepts (Berge, 1995), and assist them in meeting objectives (Laurillard, 2002).

In meeting the stated course objectives, the instructor's guidance is indispensable (Hall, 2002; Nicol & MacFarlane, 2006). Goals/standards/criteria of performance or an assignment affect how students are going to complete a task and interpret feedback provided by an instructor. Students' engagement in completing a given assignment is for the purpose of deepening understanding based on the objectives set in advance. Unfortunately, it is quite common that students may have trouble understanding objectives and goals fully before an assignment is completed. One of the reasons is that making assessment goals or criteria explicit can be a difficult undertaking (Rust, Price, & O'Donovan, 2003). "Statements of expected standards, curriculum objectives or learning outcomes are generally insufficient to convey the richness of meaning that is wrapped up in them" (Yorke, 2003, p. 408) and "[t]hey are often 'tacit' and unarticulated in the mind of the teacher" (Nicol & MacFarlane, 2006, p. 206) owing to their complex and multidimensional nature. To bring about effective performances, an instructor is obligated to aid students in establishing a good understanding of goals, which comes, in part, from the assessment process by offering constructive feedback.

Zimmerman and Kitsanas (2002) reported that social feedback "has been consistently linked with higher achievement and greater motivation to learn" (p. 662). Provision of feedback

is a process of scaffolding, which reflects the core concept of the 'Zone of Proximal Development,' or ZPD (Vygotsky, 1978). From Vygotsky's perspective, learning takes place in a social context, where a learner is assisted by a more skilled learning partner (Lindblom-Ylanne & Pihlaijamaki, 2003). With assistance of caring and understanding instructors, students tend to be motivated to learn. Such an environment for learning is often deemed as an emotionally supportive classroom (Hall, 2002; Stipeck, Feiler, Byler, Ryan, & Salmon, 1998; Sheppard, 2008). In the emotionally supportive environment, the psychological distance between the instructor and students is shortened and the instructor strives to cultivate positive affect for learning. Affective learning contributes to the mastery of learning (Brookfield, 1987; Christophel, 1990, Hall, 2002; Pogue & Kimo, 2006).

The same principle is applied to an assessment or grading process. In the assessment process, if grading students' work merely equates with assigning a grade or a numeral score to students' papers, possible affect for learning would not germinate and subsequently grow. Winter and Dye (2003/2004) found that students tended not to collect marked assignments and accompanying feedback if they knew their grades: "Students couldn't care less when they know their grades" (p. 138). It is apparent that if assessment is limited to gauging students' work in order to grant a corresponding grade to each student, much is missed, and the practice of teaching and learning is diminished (Chang, 2009a; Chang, in press). Such an assessment process only focuses on the evaluation of learning outcomes rather than its process (Bothel, 2002; Chang, 2007; Chang, 2009a; Siew, 2003).

Grading is, in effect, a process of teaching transpired through a meaningful dialogue in the assessment process (Chang, 2007; Chang, 2009a; Chang, in press; Hall, 2002). In such a process, an instructor diagnoses misconceptions (Chang, 2007; Chang, 2009a, 2009b, 2009c; Garrison et al., 2000) and detects learners' learning needs in order to render assistance (Berge, 1995, Chang, 2009b, 2009c) and to help remove barriers to students' successful learning (Chang, 2009c; Chang & Petersen, 2006; Ko & Rossen, 2001). The instructor's provision of feedback in the context offers knowledge useful to make corrections based on his or her content knowledge and pedagogical expertise (Higgins, 2000). The feedback can thus engage students in knowledge building (Lim & Cheah, 2003) and deepen students' knowledge (Chang, 2007; Chang, 2009a, 2009b, 2009c; Chang & Petersen, 2006; Garrison et al., 2000; Higgins, 2000; Kanuka & Anderson, 1998; Winter & Dye, 2003/2004). Dynamic involvement of an instructor in student learning emphasizes process rather than products; connectivity and process vs. products and a repository of information (ESRC Economic and Social Research Council, 2002; Siew, 2003),

Personalized online coaching can also be expounded and understood with Garrison, Anderson, and Archer (2000) three presences: cognitive presence, social presence, and teaching presence. Cognitive presence exists when there is communication between the instructor and student centering on the student's written work. Garrison et al. (2000) noted that there was a positive link between written communication and a higher order of thinking. In the critical discourse with the student, the instructor interacts with the student, which represents social presence and which is fundamental to successful attainment of knowledge. Assisted by the instructor's explanatory feedback (teaching presence), students gradually learn how to think as the dialogical communication is domain-specific and context-dependent. Garrison et al. pointed out, "Explanatory feedback becomes crucial when one's ideas are being constructively but critically assessed" (Garrison et al., 2000, p. 25). Feedback from the instructor directs students to focus on what to think (cognitive presence) (Garrison et al., 2000). Hence, students learn to

question the information they have attained rather than to simply translate it into one's words without thinking and reflection, which is coined by Hall (2002) as "a knock-on effect" (p. 157).

B. Students' Perceptions.

Young and Norgard (2006) examined the quality of online courses from the students' perspectives. Of 233 participants, about 90% surveyed agreed that the interaction between the instructor and students was important to learning. The researchers found that timely interaction between the instructor and learners was crucial in promoting student learning. The students felt that when there was an absence of the instructor's presence, they were unsure of themselves with respect to learning outcomes, which was consistent with the reports by Yang and Cornelius (2004), and Zeng and Perris (2004).

Hong (2002) explored 26 students' perceptions about an e-problem-based course and found that students who had positive perceptions about the student-instructor interactions felt more satisfied with the course than those who held a negative attitude concerning the relationship between the instructor and students. Jiang and Ting (1998) and Swan et al. (2000) pointed out that interactions between the instructor and students made the most significant contribution to the learners' satisfaction and desirable learning outcomes in Web-based courses. In short, students' satisfaction is closely linked to the instructor's highly visible and tangible presence.

Dennen et al. (2007) conducted a study with 32 instructors and 170 students to examine their perceived importance of particular instructor's actions on performance and satisfaction. They found dissonance between instructors and students in terms of the perceived importance of various instructors' actions on course satisfaction. The majority of the students placed the provision of timely feedback at a much higher rank (ranked 1st) than did the faculty members (ranked 4th), which implies that the students expected the instructor's feedback in a quick fashion. In terms of extensive feedback, 96.9% of the faculty members ranked it first while 82.9% of the students ranked it the ninth place. The statistics show that the students preferred the feedback that the instructor returns quickly, but do not appreciate lengthy feedback.

III. Methodology.

A. Research Design.

To answer the research questions of "Are students satisfied with the way the instructor provided feedback to their submitted online assignments?" and "How does feedback facilitate student learning?"a survey was used to solicit the students' perceptions. The use of the survey rather than that of interviews were due to the following reasons. Given the fact the students must have the experiences of receiving and communicating with the instructor about the e-feedback, the end-semester data collection would make much sense. However, at the end of a semester, there was always very little time left for both the researcher and the participants to meet face to face individually in order to complete interviews, owing to much work and other obligations demanding the attention of both parties. Therefore, the survey was used as the data collection means.

B. The Study.

This study was approved by the IU Institutional Review Board and took place on an IU campus with 20 students enrolled in two sections of a course titled "Introduction to Early Childhood Education" in the spring semester of 2009. This course was required of all pre-service teachers seeking teaching licenses and Elementary Education degree.

In this web-enhanced or a hybrid course, the instructor and students met on Tuesdays and Thursdays for 75 minutes each session. Not only was computer technology incorporated into face-to-face meetings, but also was continuously utilized outside of the class. That is, all the students were expected to submit their assignments through Forums via Oncourse (https://oncourse.iu.edu/portal) and the subsequent communications between the instructor and students also took place via the Internet outside of the class. As a means of individualized coaching, the written feedback was detailed, pointing out strengths and weaknesses in relation to a particular requirement and was delivered electronically to the students no more than 24 hours. The identification of students' written mechanical errors was also part of the feedback.

Upon the receipt of the instructor's feedback, students were allowed to make revisions within 30 days, starting a due date. If a student decided to opt out the opportunity to make revisions, all he or she needed to do was to email the instructor, who then awarded a grade to the student's submitted assignment based on the quality of the work. If making revisions was the choice of a student, within the 30 days, ongoing communications between the instructor and student would focus on the student's assignment content until satisfactory outcomes were recognized by either or both parties (the instructor and/or the student). Each time after the instructor reviewed the resubmitted work, the student's grade might be readjusted depending on the quality of the revisions.

C. The Survey.

The survey instrument was developed by the researcher/instructor. Three initial questions sought demographic information, such as student status (grade level), grade point average (GPA), and age. The demographic information was followed by a closed-ended question that was intended to solicit the students' preferences regarding the instructor's detailed feedback on a five-point Likert scale, with 1 being the least supportive and 5 being the most supportive. And then an open-ended question was intended to seek the students' justifications for their varying levels of preferences.

The next two survey questions intended to solicit the students' perceptions with respect to seven types of feedback and their justifications for the choices they made. This was an attempt to answer the second research question of how the e-feedback promoted student learning.

Then the students were asked to share their preferences as to where they would like feedback placed in their paper, being in the margin (as specific feedback) or at the end of the paper (as general), or both. Relevant justifications on this topic were also sought in order to answer the second research question as to how the e-feedback facilitated student learning.

The next two survey questions asked the students to report whether or not they a) had easy access to computers and the Internet, and b) were interested in learning with computers. These survey questions were intended to assist in answering the research questions as to whether or not they would support the e-feedback and how the e-feedback facilitated student learning. In other words, it might be the case that if a student had his or her personal computer and access to

the Internet, it would be likely that he or she would support e-feedback and find that e-feedback facilitated their learning.

The last two survey questions sought the participants' perceptions of what and why percentages of online computer technology they preferred to be integrated into a university course. These survey questions enabled the researcher to answer the research questions from a different angle: If the students felt that they benefited from e-feedback, they would preferably suggest more percentages of computer technology to be included in their learning, i.e., increasing more percentages of computer technology in classroom instruction in order to help them learn better.

This survey instrument had been read and reread by two education professors who were knowledgeable about instructional technology. Their feedback and input led to the modification and refinement of the instrument. In addition, the instrument was tested with other education students and, again, revisions were made before the survey was formally used.

D. Data Collection.

At the end of the spring semester of 2009, 20 participants filled out the survey questions voluntarily. After the researcher/instructor explained the purpose of this survey and responded to all the questions from students, a student volunteer was identified to collect the completed surveys in an envelope before delivering it to the assistant Dean's office. The researcher was absent in the classroom where the survey questions were being completed. The envelope was retrieved after all the grades were posted online.

In the informed consent form approved by the Institutional Review Board and distributed to the students along with the surveys, the purpose of the study, voluntary participation, and confidentiality were clearly stated and explained to the participants.

E. Data Analysis.

Descriptive statistics were performed to answer the research questions of whether or not the students were satisfied with the way that the instructor offered the feedback to their online assignments and how e-feedback facilitated student learning. To answer the second research question, a Pearson Product Moment Correlation was also performed in order to examine the relationship between the supportiveness of e-feedback and factors that included students' age, student status, GPA, interest in learning with computers, having access to computers and the Internet, and percentages of computer technology integration into classroom instruction. To answer the second research question, a qualitative analysis was also performed, which consisted of coding the survey responses and of aggregating the codes to identify themes (Charmaz, 2000; Creswell, 2002). Three surveys were first randomly selected, read, and coded with the abbreviations of the tentative codes. The resulting coding system became the basic coding guide for the remaining survey data (see Table 1). The codes were continuously modified and refined as every survey was compared, analyzed, and coded. The process ended when all the data were matched with their appropriate codes.

Table 1. Coding and examples.

Code	Meaning	Examples
H	Helpful	The comments are helpful for learning the material.
		The feedback helped me develop my papers (ideas) to the fullest.
		The feedback makes the assignments easier to correct.
		Dr. Chang's online feedback was always prompt and encouraging to do better as a student to further our education.
		I appreciated its immediacy and specificity.
		It was easy to read since it was typed.
		It was good to have the comments at exactly where the comment was regarding the assignment—instead of at just the bottom of the assignment.
P	Prompt/Immediate	Dr. Chang was very timely and helpful with her suggestions.
CV	Convenient	I support online feedback because it is easier to submit and correct papers from the comments.
		. . . it is very easy to respond via emails so I like the accessibility.
		You are saving trees because we are not printing out multiple copies.
NE	Negative	I didn't give you "5" because there was a lot [nit-picky]and it overwhelmed me sometimes and shut me down.
		Sometimes it's hard to know what you are referring to when the feedback is done online. . .
		I don't have internet at home so it was difficult.

IV. Results.

Descriptive statistics were performed to answer the first research question, "Are students satisfied with the way the instructor provided feedback to their submitted online assignments?" Table 2 shows that 13 students (65%) strongly supported while four students (20%) supported the practice ($M = 4.45$, $SD = 0.89$).

The answers to the second research question, "How does it [the feedback] facilitate student learning?" were gained through various channels, which started with the qualitative analysis of the participants' justifications of the way that the instructor provided feedback to their submitted assignments. The analysis resulted in four emerging themes: beneficial, immediate, convenient, and negative. Most of the students (85%) felt that the feedback was beneficial to their learning. Convenience in sending and composing revisions was also favored by the students

(20%). In terms of immediate feedback, three students (15%) clearly noted that immediate feedback was useful in advancing their learning. However, two students (10%) justified their negative views.

Table 2. Degree of participant support of instructor's online feedback.

Strongly Support	Support	Neutral	Against	Strongly Against
13 (65%)	4 (20%)	3 (10%)	2 (5%)	0 (0%)

To answer the second research questions, Table 3 shows the results of the participants' preferences with respect to the types of feedback students deemed to be helpful for their learning. (Note, these types of feedback may also be applicable to any methods of instruction, including face-to-face meetings, blended learning, or online learning. Since the focus of this study was placed on the perceptions of the students' experiencing e-feedback, feedback offered electronically was the center of the attention).

Table 3. Students' preferences to the seven types of feedback.

	Type I like feedback that	Number
1	Confirms with a positive short note, such as "A good point."	17
2	Confirms with a positive short note like the above with an extension to explain it, such as "I like this because . . ."	17
3	Helps me improve the use of APA style.	17
4	Provokes my thinking, such as "What do you think about this observation you made . . ."	14
5	Encourages me to reflect upon my work, such as "Please go back to your objectives to reexamine your assessment."	14
6	Helps me be aware of spelling and grammar mistakes.	14
7	Encourages me to reread the guidelines, such as "Please reread the guidelines before revising this part."	8
8	Others (please specify)	0

To further explore how the e-feedback facilitated student learning, the researcher examined the students' perspectives as to where the feedback was preferably placed in a student's assignment. The result shows that eight students preferred to have the feedback offered in the margin of a paper (specific feedback) while four preferred to receive "general" feedback

that appeared at the end of the paper. Yet, most of the students (11 students) liked feedback to be placed both in the margin (specific feedback) and at the end of the paper (general feedback).

To continuously answer the second research question of how the feedback helped students learn, descriptive statistics were performed on age, student status, GPA, interest in learning with computers, and percentage of the students' willingness to include computer technology into instruction and learning (see Table 4). And then a Pearson Product Moment Correlation was performed to examine the associations between feedback and age, status, GPA, interest in learning with computers, having access to computers and the Internet, and percentage of online components integrated into a course. Table 5 shows that there are no statistically significant correlations among any of the relationships.

Table 4. Descriptive statistics.

	N	**Minimum*	***Maximum*	*Mean*	*Std. Deviation*
Age	20	2.00	4.00	3.10	0.64
Status	20	3.00	4.00	3.35	0.49
GPA	20	2.00	4.00	3.65	0.67
Learning	20	2.00	3.00	2.85	0.37
Access	20	1.00	2.00	1.95	0.22
Percentage	20	2.00	7.00	4.10	1.52
Feedback	20	2.00	5.00	4.45	0.89

*Age 2.00=21-24 *Status 3.00=Junior *GPA 2.00=2.00-2.5 * Learning 2.00=Interested in learning with computers *Access 1.00=Having access to a personal computer * Percentage 2.00= 20% * Feedback 2.00=Disagree ** Age 4.00=>30 **Status 4.00=Senior **GPA 4.00=>3.0 ** Learning 3.00= Not interested in learning with computers ** Access 2 = having no access to a personal computer ** Percentage 7.00= 70%** Feedback 5.00=Strongly supportive

V. Discussion.

The study was intended to explore whether the students were supportive of the e-feedback provided by the instructor and how the feedback facilitated their learning. The results of the study demonstrate that the majority of the students (85%) supported the way that the feedback was offered. The students highly preferred the e-feedback offered by the instructor through the assessment process, because the instructor offered extended instruction outside of class to each student that was comparable to his or her actual learning level (Chang, 2009a, 2009b, 2009c). As the individualized coaching, e-feedback was useful and beneficial to student learning, which was recognized by Cindy, "Your comments assisted in learning." Carly and John concurred, "The instructor was very timely and helpful with her suggestions" and "The comments are helpful for learning the material." The finding was also consistent with the reports by MacDonald and Twining (2002) as well as by Orsmond and Merry (2011) that feedback helped student learning. Specifically, the instructor's e-feedback was conducive to the participants' acquisition of concepts (Berge, 1995) and to meeting objectives (Laurillard, 2002). The research result was in line with Garrison et al.'s (2000) three presences, namely, three presences (namely, teaching, social, and cognitive). That is, the instructor extended instruction through the assessment process

even when the class was not in session (teaching presence). The e-feedback was intended to deepen the students' understandings of course-related materials (cognitive presence), which transpired through e-communication that exclusively centered on the students' assignments (social presence).

The reason that the e-feedback could benefit students learning can also be reflected from Ashley's comment: "I felt it gave me the knowledge that I was on track." Sandra added, "I like to be told exactly what is wrong with what I am doing." The findings were consistent with the reports by Yang and Cornelius (2004), Young and Norgard (2006), and Zeng and Perris (2004) that the feedback enabled students to know what to improve and what to correct. Chang (2007), Chang (2009a), (2009b), (2009c); Chang and Petersen (2006), and Garrison et al. (2000) put forward that based on his or her content knowledge, an instructor was able to appropriately identify misunderstandings and offer knowledge so that students were able to enhance their own learning through corrections. The diagnoses were communicated through the instructor's feedback. And the remedial or diagnostic feedback to students' responses could advance their knowledge building (Lim & Cheah, 2003).

Table 5. Associations between feedback and other independent variables.

		Status	GPA	Learn	Access	%	Feedback
Age	Pearson Correlation	.554*	0.086	0.291	0.037	-0.065	0.287
	Sig. (2-tailed)	0.011	0.719	0.212	0.878	0.786	0.220
Status	Pearson Correlation		-0.088	0.308	0.168	0.092	0.346
	Sig. (2-tailed)		0.712	0.186	0.478	0.699	0.136
GPA	Pearson Correlation			-0.011	-0.123	-0.171	0.279
	Sig. (2-tailed)			0.964	0.606	0.472	0.234
Learning	Pearson Correlation				.546*	-0.255	0.057
	Sig. (2-tailed)				0.013	0.277	0.812
Access	Pearson Correlation					0.171	-0.146
	Sig. (2-tailed)					0.472	0.539
%	Pearson Correlation						-0.191
	Sig. (2-tailed)						0.419

*. Correlation is significant at the 0.05 level (2-tailed).

E-feedback could also provoke the students' thinking, thereby promoting their learning. Amanda and Holly confirmed, "She gave very thorough feedback that made me think about what I was doing and learning," and "I really like when I received feedback that made me rethink what I wrote and also got me to analyze something more." Garrison et al. (2000) supported the notion

that as the dialogical communication was domain-specific and context-dependent, it directed students to focus on what to think. Garrison et al. affirmed that there was a positive association between written communication and a higher order of thinking. This kind of scaffolded communication attends to learning process rather than products (ESRC Economic and Social Research Council, 2002; Siew, 2003).

The reason that the feedback was conducive to student learning was also due to its specificity and straightforwardness. In regards to the nature of specific feedback, the majority (n=17) liked the feedback that conveyed words like, "A good point." Alisa noted, "I like to know when I have a good idea and the teacher notices it." However, this type of feedback would be more useful when it was backed up by the instructor's explanation, as expressed by Emily, "I like when she explains why she liked a certain point instead of just saying it was good." Furthermore, the students perceived that it was helpful when feedback specially pointed out weaknesses, such as the APA style formatting requirement, and grammatical and mechanical errors. A student wrote, "I am continuing needing help in spelling and grammar." And another said, "[It] help me take responsibility for my work and allow me to learn from my mistakes."

The helpfulness of the detailed e-feedback lent itself to the improvement of students' time-management skills. Although this was not overwhelmingly perceived as the factor for the facilitation of their learning, addressing it here would be worth the possible promising discussion in the near future. Eminia commented, "The instructor is right to the point and is concise in her feedback. It is helpful because there are about twenty other things we need to read or correct on top of hers, so it helps for time management." Piffell and Sibley (2003) believed that feedback was tied to three components useful for effective learning. These include self-motivation, time management, and organization. In this sense, the feedback encouraged the students to reexamine their ways of managing time and organizing their learning process (Chang, in press). Equally important is the notion that individualized instruction also helped students' writing skills, "This . . . helps me improve my writing skills" (Jennie, Spring, 2009). Admittedly, there was only one student specifically indicating the positive relationship between the e-feedback and writing skills. Further endeavors need to be taken to investigate this issue.

In exploring how feedback facilitated student learning, the notion of where the feedback ought to be posted should not be overlooked. Many students (40%) preferred the feedback placed in the margin of a paper or the specific feedback, because "It was good to have the comments at exactly where the comment was regarding the assignment—instead of at just the bottom of the assignment" (Ali) Samantha also commented, "Having the remarks on the side left on question to what you were talking about" avoided confusion as noted by Orsmond and Merry (2011). As a matter of fact, the majority of the students (78%) actually wanted to see the instructor's feedback offered both in the margin and at the bottom of a paper. A student reasoned, "I appreciate both comments as one allows for more detailed explanation and one allows for pinpointing of small problems with work." Sally added, "(Both) are helpful in correcting and improving work which also increase the amount of learning acquired." It is apparent that the e-feedback placed in the margin as well as at the end of the paper served various purposes, all of which were geared toward the promotion of student learning and reducing the psychological distance between the instructor and student. The way that the e-feedback was noted might help prevent different levels of frustration from taking place and help the students know the expectations and ways to reach objectives. This kind of learning environment positively affects students' disposition to learn (Christophel, 1990, Hall, 2002; Stipeck et al., 1998; Sheppard, 2008). And their affect for

learning is conducive to the mastery of learning (Brookfield, 1987; Hall, 2002; Pogue & Kimo, 2006).

The promptness or immediate feedback was also one of the rationales to facilitate student learning, which was consistent with Dennen's (2006) finding that a great number of the students placed immediate feedback at the top rank. Brianna noted, "This way [feedback] I knew what needed to be adjusted right away." The student's perspectives were also substantiated by Piffell and Sibley (2003) in that frequent and detailed hints (programmed feedback) were fundamental to students' significantly increasing ability to learn. Prompt feedback was not only helpful, but also enabled the students to understand the course materials (Piffell & Sibley, 2003; Song, Singleton, Hill, & Koh, 2004). Although there were only three students who provided the justifications on this theme, it by no means indicates that the participants were against immediate feedback. The reason for a lack of identification may be because the students might take for granted that feedback provided by the instructor was always received within 48 hours. Nonetheless, further investigations on this variable would be very useful.

Convenience is the third factor that the students endorsed in terms of e-feedback being conducive to their learning. Considering that most of the students currently in college are Generation Y, who are "extremely comfortable with technology" and have no real memory of life without computers, cell phones, and digital music (Rockler-Gladen, 2006), typing is preferred than writing when it comes to completing assignments. To send the completed homework directly to the instructor at any time before a deadline, all a student needs to execute is a few clicks. The instructor's responses can conveniently be received electronically and quickly as well. Reading the feedback and revising one's work according to the feedback can also happen when a student feels mentally ready or when he or she has time regardless of where he or she may be, as online communication is entirely independent of location, fostering students to become the owners of their own learning (Chang, 2009b). Ali wrote, "It all allowed me to be responsible for my own learning as well as learn from (and correct) my mistakes."

In comparison, "inconvenience" characterizes those who conveyed displeasing feelings toward the feedback. Although there were only two out of 20 students held these perceptions, it would be beneficial to discuss them here. Inconvenience, in part, included a students' inaccessibility to the Internet, "I don't have internet at home so it was difficult" (Melissa). This inaccessibility must have resulted in the student, who had to stay in a computer lab longer than others did or who had to find an alternative means to complete, submit, and revise homework. Thus, meticulous time management skills apparently became a big challenge to the student. Yet, interestingly in contrast, a participant, who did not even own a computer, strongly supported the feedback. In addition, this study confirmed the notion that there was no significant association between the support for e-feedback and the status of owning a computer. Nevertheless, this sharp contrast poses a potential future investigation opportunity.

"Inconvenience" can also be explained by what a student termed as "pickiness." From her perspective, the instructor should not have paid attention to many seemingly minor errors, such as misspellings, mechanical mistakes, grammatical mistakes, and the illogicality of a paper. But, the instructor's major focus should be placed on content, because if all these errors needed to be fixed, it would certainly be time-consuming, thereby being inconvenient. Should or should not an instructor point out "minor errors?" If not, does it imply that an instructor is supportive of the paper filled with the minor errors? Could the minor errors potentially become "major errors" that would make the instructor' review or comprehension of the content difficult? These questions indeed require further investigations.

In facilitating student learning, it appears that the way the instructor offered the feedback mostly suited older students (25 and above, M = 3.10, SD =0.64), juniors and seniors (M = 3.35, SD = 0.49), those who held a 3.0 or better GPA (M = 3.65, SD = 0.67), and those who had easy access to a computer and the Internet (M = 1.95, SD = 0.22). However, considering there were no apparent statistically significant relationships between feedback and age, student status, and GPA, future research effort is necessary to advance the understanding by confirming the study results and/or by exploring if younger students and those who have lower GPA may be unsupportive of receiving and revising work according to e-feedback.

Although there were no statistically significant relationships between supportiveness of feedback and interest in learning with computers and a certain percentage of computer technology integrated into a course, one aspect warrants a discussion. It is understood that receiving e-feedback from the instructor and revising an assignment according to the feedback are considered computer-technology assisted learning or, in short, learning with computers. The participants were informed by the survey as well as by the researcher prior to their completion of the survey that online communications with the instructor based on the e-feedback constituted 30% of the entire course. In answering the survey question of how many percentages the students preferred to have computer technology integrated into the course, surprisingly less than 50% of the students noted that no more than 40% of the course should be computer-technology assisted or Web-enhanced. This finding demonstrates that even though the majority of the students (85%) supported the way that the instructor provided e-feedback to their work, in regard to the incorporation of computer technology into their teaching and learning, the students were willing to only increase less than 10% of computer technology in their course. Interestingly, however, most of these students (89%) claimed they were interested in learning with computer. These findings may explain that the students might not be completely ready to take charge of their own learning, as it is understood that receiving and reading feedback along with revisions according to the received feedback are all self-regulated activities, requiring reading, independent thinking, time management, and self-motivation for self-development. After experiencing the online dialogical communication with the instructor, the students might feel that the traditional face-to-face meetings were still relatively a comfortable learning means. This could be translated to the notion that these participants might prefer to travel twice to and from campus every week, irrespective of weather conditions, than simply stay put and learn with computers in "pajamas" (web-based or online course). The findings imply that, in facilitating student learning individually and electronically through the process of assessment, an instructor should take into account students' characteristics, especially the possibility that even though students declare to be interested in learning with computers, too much expectation of independent learning with the use of computer technology may adversely affect otherwise positive affect for learning and mastery learning. For this, it may be useful to explore, as future research effort, what "learning with computer" means to students and also what are rationales behind students' "fear" of involvement in online independent learning.

VI. Conclusion.

The study placed its focus on whether or not the students supported the way that the instructor provided feedback to their assignments and how the feedback facilitated their learning in the online component of the course. It is concluded that the way the instructor offered feedback to the students' assignments was widely welcomed by the students. The feedback guided them

individually through the assessment process to develop an understanding of how to improve their performance, encouraged them to think at a higher level, pointed out areas that required their attention, addressed their time management skills, and helped improve their writing skills. The feedback that was provided quickly also played a major role in providing scaffolding for student learning. The students' favorable feelings toward the feedback were also due to the fact that it was convenient for the instructor and students to communicate electronically centering on submitted or revised assignments.

Although providing explanatory and diagnostic feedback is time consuming, this study demonstrates that it is worth the instructor's efforts. In Rowntree's (1987) words, feedback "is the life blood of learning (in Winter & Dye, 2003/3004). As shown by this study, the students benefited from e-feedback in many ways. This study also indicates that many students need guidance from the instructor to enhance their learning, even when it is outside of class time. Although this study just focused on e-feedback, it is acknowledged that in-person feedback would play a similar role in facilitating student learning, as pointed out by Hatziapostolou and Paraskakis (2010), "Feedback is an essential component in all learning contexts" (p. 111). Therefore, providing feedback to students' assignments that is timely, detailed, and straightforward would be beneficial to student learning.

In the facilitation of student learning via the Internet, an instructor should keep in mind that feedback offered at the end of the paper as well as in the margin of a paper with the use of New Comment are all conducive to student learning. Sometimes, it could be helpful if an instructor explains why a certain point made by a student is "a good point." If an instructor perceives that certain aspects require students' attention, a detailed explanation or reasoning is necessary. A simple notation may become a vague message to students that may result in students' frustration. Using the Track Changes feature offered by Microsoft Word would be useful for an instructor to point out errors or areas needing students' attention.

An instructor can take advantage of what course delivery system can offer by making it clear to students that assignments can be submitted whenever they believe that the quality of work is completed as long as it is done by a due date. In this way, the instructor can break a large workload into smaller manageable pieces and would have time to provide constructively useful feedback to meet the individual student's needs, hence helping the student gain knowledge or aid him or her to reach the learning objectives.

An instructor also needs to take into consideration how to approach those who may or may not be interested in learning with computers. That is, how to present what needs to be said as feedback may affect students' reception and understanding of feedback.

Research effort can be exerted to examine the length of specific feedback, as a student noted in the survey that short feedback was abrupt. This is certainly not consistent with Dennen et al.'s (2007) finding that in terms of extensive feedback, 96.9% of the faculty members ranked it first while 82.9% of the students ranked it the ninth place. An investigation may be helpful to explore this aspect. In addition, future research endeavors could also focus on whether or not feedback should strictly be targeted on content knowledge without regard to grammatical, spellings, and mechanical errors.

A limitation may be concerned with dishonesty given that the survey was the means of the data collection. However this should be lessened by the assumption that the participants should not have many reasons to be dishonest about the responses they made in the survey. After the students completed the survey, the instructor would not have a chance to teach those participants. These participants would move to Block Two (there are three blocks plus student

teaching that pre-service teachers must undergo before they receive their teaching licenses and Elementary Education Degree. Block One focuses on early childhood, namely, from pre-kindergarten to second grade, whereas Block Two and Block Three concentrate on middle childhood, intermediate grades, namely, from third grade to sixth grade). The researcher only teaches students in Block One or courses in relation to early childhood education. Therefore, the participants should not have many reasons to intentionally conceal their true insights and/or to feel discomfort in completing the survey.

The small sample size of the study may affect the conclusion of the study. The generalization of the research findings may still need to be made with caution. Yet, the results of the study should be able to stimulate promising discussions for ways to appropriately enhance student learning with e-feedback.

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Evaluation of the ARDESOS program: An initiative to improve critical thinking skills

Carlos Saiz[1] and Silvia F. Rivas[2]

Abstract: It is desirable that reasoning, problem-solving and decision-making skills should form an integral part of our private and professional lives. Here we show how these skills can be improved through the use of the ARDESOS program. To test the effect of the program, we have also developed an assessment test (PENCRISAL). Our results are going in the desired direction. The ability to decide and make inductive inferences was improved, and this improvement was also seen in argumentation, although indirectly. In the future we must therefore improve our interventions in all factors, but in particular those referring to induction and problem-solving. Much remains to be done from the procedural point of view, but the preliminary results are very promising and we are convinced that our initiative has a good conceptual grounding.

Keywords: critical thinking, transference, assessment, instruction, reasoning, problem-solving, decision-making.

I. Introduction.

For some time we have been developing an intervention program with the aim of improving critical thinking skills. The first results of our efforts can be found in Nieto and Saiz (2008). As a result of the implications of those data, together with a profound theoretical analysis, we elaborated a first substantial conceptual modification of this intervention initiative, which henceforth will be referred to as *ARDESOS* (from the Spanish, equivalent to **Ar**gumentation, **De**cision, **So**lving of problems in daily **S**ituations) and which is described and discussed in Saiz and Rivas (2008a). However, this is only the first step in our journey, and it needs to be justified in order to be able to propose a solution to the important, still open, and unresolved problem of improving our capacity for critical reflection. Thus, in this Introduction section we shall proceed as follows. First, we shall briefly sketch a background of the field of enquiry, after which we shall delimit the sources of our work and justify it. Once we have justified our work from the viewpoint of intervention, we shall discuss the objectives of the present work, the problems addressed, and the solutions proposed.

The drive of human beings to improve their intellectual capacity is as old as the first cultures in which teaching played a role. Perhaps the place where this quest received the greatest attention, at least within Western tradition, was in Ancient Greece, with the first Pre-Socratic learned men. From these beginnings to the present day, important efforts have been made to improve our thinking skills, such as projects, involving *Instrumental Enrichment or Project Intelligence* (Nickerson, Perkins & Smith, 1985), among others. During the last two decades, ways of teaching students to think were developed, based on work addressing critical thinking, such as that of Ennis (1996). Currently, this line of critical thinking is probably the most fruitful

[1] Facultad de Psicología. Universidad de Salamanca. Avda. La Merced, 109. 37005 Salamanca. Spain. csaiz@usal.es
[2] Facultad de Psicología. Universidad de Salamanca. Avda. La Merced, 109. 37005 Salamanca. Spain. silviaferivas@usal.es

as regards initiatives of this kind (for a review of the justification, see Saiz, 2002a). Our work on instruction belongs to this tradition.

Critical thinking is a still heterogeneous concept and there are an excessive number of ideas about it (see Ennis, 1987; Lipman, 2003; McPeck, 1981, 1990; for a review of the concept sees Nieto & Saiz, 2008, and Saiz & Rivas, 2008a). Ours is explicit in the definition: we understand that "*Critical Thinking* is a process involving a search for knowledge through reasoning skills, problem-solving and decision-making that will allow us to achieve the desired results more efficiently" (Saiz and Rivas, 2008a, p. 131). Inference, or judgement, is what we essentially find behind the concept of thinking. However, is thinking only reasoning? Some authors believe so (Johnson, 2008), while others do not, assuming that solving problems and making decisions are activities that also form part of thought processes (Baron, 2005; Halpern, 1998, 2003; Mercier and Sperber, 2010). In this latter view, achieving our goals does not depend solely on one intellectual dimension. All three are important: not only reasoning, but also decision making and problem solving. From the viewpoint of psychology, these skills form part of our most valuable cognitive tools, something that is not contemplated in the more philosophical traditions. The difference between these two approaches is epistemological. Each responds differently to the following question: Should we have a theory about reasoning or about action? From the point of view of philosophy, we should work on a theory about reasoning, while from the psychological perspective the focus should also be on a theory about action (Saiz, 2009). Let us explore this issue further.

Normally, we think in order to solve problems or to achieve our goals. A problem can be solved by reasoning, but also by planning a course of action or selecting the most suitable strategy for the situation at hand. Thus, as well as reasoning we must also make decisions to solve our problems. Choosing is one of the most frequent and important activities that we engage in. Accordingly, we prefer to give it the importance it merits in a definition of thinking. Solving problems demands many intellectual activities, such as reasoning, deciding, planning … From this point of view, thinking is reflection and action; we can say that *thinking is reasoning and deciding in order to solve problems* (Saiz, 2009). However, the efficiency of our thinking, thinking critically, requires other components. In order to delimit the meaning of thinking efficiently, it is necessary to seek aspects outside the core, such as those depicted in Figure 1.

In Figure 1 we can find three concepts of the previous definition plus two other important components: motivation and meta-knowledge (attitudes are usually understood as dispositions, inclinations….; something close to motives but also to meta-knowledge). The fundamental nucleus of Critical Thinking continues to be that which has to do with skills, in our case reasoning, problem solving, and decision-making. But why introduce concepts of other types, such as motivation, in a description of Critical Thinking? Several years have passed since it was observed that, when addressing Critical Thinking, focusing only on skills does not allow all its complexity to be unveiled. The aim of the scheme in Figure 1 is to provide conceptual clarity to the adjective "critical" in the expression *Critical Thinking.* If we understand that *critical* refers to *efficacy,* we must also see that efficacy cannot be achieved merely with skills. Other protagonists must be brought into play, and at different times. Alone, intellectual capacities do not achieve the efficiency associated with the notion of "critical". First, for such capacities to be set in motion (for us to think) we must desire this to happen ("knowing begins with wanting", as one of our professors once said). Thus, motivation enters the game before skills; it sets them in motion. In turn, meta-knowledge allows us to direct, organize, and plan our skills in a profitable way, and it acts once skills have begun to function. The final goal must always be a desirable knowledge of

reality; greater wisdom. The author who has best posed the role of these components is Halpern (1998, 2003), on whose work we based the development of our overall conception of what Critical Thinking is.

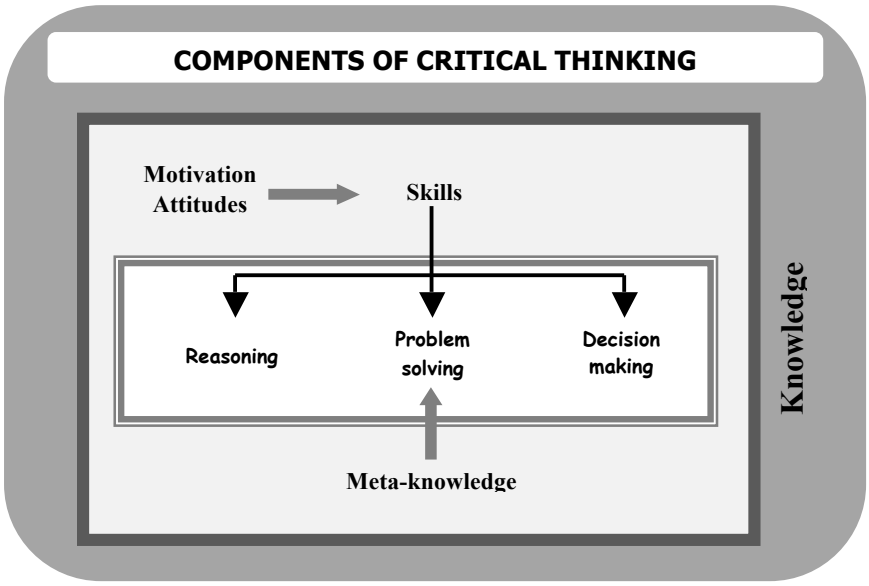

Figure 1. Components of Critical Thinking.

We believe that the fact of referring to the components of Critical Thinking, and time differentiating skills from motivation and meta-cognition, can help in the conceptual clarification we are seeking. On one hand, we specify which skills we are talking about, and on the other hand, which other components (other than *thinking*) are related to them, or even overlap them. We must be aware of the futility of the illusion of finding "pure" mental processes. Planning a course of action, an essential feature of meta-knowledge, demands reflection, prognosis, choice, comparison and assessment. … Is this not thinking? The different levels or dimensions of our mental activity must be related, or integrated. We believe that our avenue of enquiry will turn out better this way. Accordingly, our efforts towards conceptual clarification are directed to achieving that integration of the components of thinking. Our aim is to be able to identify what is substantial in thinking in order to determine what it is we can improve and assess.

Our initiative tries to overcome two drawbacks of other programs that we believe to be especially relevant. One of them is the time that many programs dedicate to intervention. Macro-programs (for example, the Instrumental Enrichment Program) aimed at teaching people how to think are limited in that they require many classroom hours for the development of intellectual skills. In most cases, similar lengths of time for working with our students are simply not available. Our instruction program can be completed in some sixty hours, which in most academic contexts is an attainable length of time. The other problem is the decontextualization of the programs designed to teach thinking, that is, the use of artificial activities. Most of the activities proposed in such programs are exercises and tasks that have little to do with the sphere of daily life. Such a departure from "reality" poses serious problems as regards instruction efficiency. One way of solving this is to propose a *problem-based learning approach*, employing tasks taken from daily situations, as we describe below.

The procedure used by us consists in directly teaching each of the three main skills mentioned above (see figure 1). These skills are essentially procedural knowledge, such that "doing" is more important than "describing how to do things". Also, since our aim is to generalize such skills to daily contexts, they should be practiced in different domains to increase the possibility of their use in any of them. However, although important, these two activities - practising and doing so in different contexts- are not as important as a third one. The most important terrain of our actions is the sphere of daily activities, common situations, and it is here where our main interest lies: ensuring that the main skills will be used in these situations. Thus, what we are seeking is above all for the transfer to materialize in daily life. If the difficulty in generalizing our intellectual skills lies in the huge difference between the field of acquisition and that of application, we should strive to eliminate or reduce such a difference to a minimum. This will be the core of our instruction, aimed at the greatest generalization possible of our essential skills to daily situations. Thus, the pillars of our intervention are *a lot of practice, interdomain practice, and tasks based on daily situations*, together with *biases* or *distortions*, which will be addressed later

To reduce the difference between the domain of intervention and that of application, it is necessary to use tasks or problems akin to those encountered in daily life. In many cases, the materials, tasks or problems used are of the following type: "If the card has an even number on one side, it will have a vowel on the other, and it is true that it does not have an even number on one side, hence it will not have a vowel on the other side". Such exercises are too artificial. We can learn a form of conditional reasoning with the previous task (in this case, one of the most common fallacies, negation of the antecedent) but it will be very difficult to apply it in our daily lives. However, we use a daily problem (at least for those familiar with court juries) in which the same fallacy appears. It is very likely that in similar daily situations such a conditional error would be readily identified. Let us explore the following task (adapted from Halpern, 2003):

> **Example 1.** A jury must decide on the guilt or innocence of someone accused of murdering a young woman on March 18, studying the arguments and proofs of the prosecution and of the defence. The relevant data in the case are as follows. The accused has a perfect alibi as from 23:00 h for that 18th of March. In the trial, proof in favour of and against the accused is heard by the jury members. Also, all the witnesses related to the place of the crime are interrogated. However, as well as focusing on these data and testimonies, both lawyers make every effort to emphasize the actual time of death of the victim. Concerning this point, the police investigators establish that the murder occurred before 23:00 h. After deliberating, the jury emits a verdict of guilty. The main argument on which they base their decision states that the accused would be innocent if the crime had occurred after 23:00 h but since the crime took place before that time, the accused is clearly not innocent but guilty.
>
> Did the jury make a reasonable decision? Explain why or why not.

A task-problem such as Example 1, which simulates a daily situation, has at least two advantages; it may be interesting *per se*, and its context is similar to a real-life one. If we can manage to stimulate greater interest in the task, this will affect the efficiency of learning, and if we can manage to ensure that the distance between the academic context and the real world is minimum we can achieve a greater application of the acquired or improved abilities. Once the intervention has been posed as a procedure of simulation of our daily functioning, we must now

detail it in terms of specific, not general, skills such as reasoning, problem solving and decision-making. Let us start with the first of these.

As mentioned, reasoning is an important mechanism of thinking. Nevertheless, there are many forms of reasoning. In Example 1 above, we illustrate one such form –conditional reasoning-, which is probably the most important of all, since explanations (causal reasoning) and the procedures of hypothesis testing (hypothetical reasoning), to mention just two, depend on it. However, this task of introducing reasoning into our daily functioning is much harder than what can be gathered from Example 1. Although we use specific daily situations for some of the types of reasoning in our instruction, we face the problem of argumentation -informal or practical reasoning- (Johnson, 2000, 2008; Govier, 2005; Saiz, 2002b; Walton, 2006). In our daily activities, we must assess or produce arguments to defend points of view, positions, theses, etc. Argumentation is possibly the most common and natural form of human reasoning. Its importance is such that it has been a focus of research along a large part of the tradition of critical thinking; that encompassed within informal or practical reasoning. In 1958, Toulmin (2003) proposed a model of argumentation that continues to be a reference for human reasoning today (see Blair, 2009). In the tradition of critical thinking, this scheme of Toulmin's has persisted and has become more understandable and applicable. However, what is missing is its use as an integrating framework of all modes of human reasoning. We have done this, in the way to be explained below. In our daily reflecting, when defining a point of view or explaining certain observation, we use analogic, causal or conditional arguments, to cite the most frequent. In teaching reasoning, what is the best way to proceed? Working separately with each form of reasoning, or integrating them in a general scheme? In most cases, we argue by integrating specific forms of reasoning within an argumentative or general explanatory line. Since this is a natural way of reflecting, let us proceed in the same way in our instruction. Other authors use another form of direct teaching of argumentation that is also efficient, although not so much (see Bensley et. al. 2010). We have opted for an argumentation task that includes different forms of reasoning, together with specific tasks for some of them that are difficult to integrate into an argumentative text. We have selected or drafted argumentative texts of some 2,000-3,000 words in length in which there are different argumentative structures: propositional, causal, analogical … In a task of this kind, we can explore different forms of argumentation in a single text in a natural way.

By integrating most of the reasoning within a general model of analysis we achieve a better understanding of the principles, and hence greater efficiency in the assessment of their soundness. However, it remains for us to describe the *problem solving* and *decision-making* tasks. We shall therefore recourse to Examples 2 and 3.

The tasks designed for these other basic skills involve situations common to many people. Again, we are attempting to simulate real problems within the academic context in order to facilitate transfer. In Example 2, we pose a common problem in which efficient strategies for solving problems must be brought into play. A general solution system, such as that of Bransford and Stein (1993) is perfectly applicable to situations such as that seen in the example.

> **Example 2.** Julia is 28 years old and only has primary education and she has been working for 10 years in a ceramics factory with three shifts (morning, afternoon, night) that rotate every 23 days. She earns 950 euros/month. She is tired of working so hard and hates the poor schedule and the low pay. She is disillusioned about her job prospects because she knows that with her academic background

she is unable to aspire to a better job situation. She has decided to see how she can improve her professional status and to do so she has given herself some time to think about it. She has decided to go on the dole for a year and a half. Unfortunately, she has a 35-year mortgage to pay off and some money to pay for the car she has brought recently. Such debts really do not allow her to be out of work for any length of time.
What would Julia's best plan of action be in these circumstances?

In Example 3, the problem is similar to that of Example 2, except that it focuses on the options of solution and hence on the task to be decided. In this way, our aim in the instruction is to stimulate the use of correct judgements about probability in order for sound decisions to be made. However, the use of general decision-making procedures is also fostered, with a view to boosting the necessary use of strategies for planning how to tackle a problem. This meta-knowledge factor is essential in all problem-solving tasks, together with "rethinking" the whole process of solution.

Example 3. Julia is studying the profitability of setting up a business, such as a gift shop. At the Chamber of Commerce she is given information about how many establishments of this type there are in her city and how they are doing. She is told that there aren't many of them and that according to the protocols used to estimate the profitability of such businesses they do have a success rate -of working profitably- of 60%. She is also told that the success of this kind of business can be improved to a considerable extent if the proprietors specialise in 10 products representative of the area. In these cases, the profitability of the shop will rise to 90%. Julia doesn't know whether setting up a business like this will allow her to get by because she must take into account the investment she will need to launch such an enterprise. At the agency, she is given further details. A shop of this kind will have expenses of around 600 euros. This does not include the opening costs, since the Regional Administration is prepared to cover 100% of these. Another aspect to be taken into account is the profit margin over a month. She is told that she can easily make 3000/month.
How should Julia proceed to assess the profitability of this business venture?

In the ARDESOS progam, we also attempt to foster attitudinal aspects through interest and *motivation* by using tasks that can be found in daily situations and that involve topics relevant to most people, such as education, health, leisure, etc. In our research, we are attempting to clarify what is understood by motivation or disposition with a view to incorporating such a distinction, more or less directly, into instruction. An excellent stance regarding this issue is that of Valenzuela and Nieto (2008). In their work, four motivational aspects were selected that in our opinion seem to be the most relevant to instruction; namely, *attainment, utility, cost* and *interest*. In their study, two of these aspects have proved to be especially relevant to Critical Thinking: *utility* and *interest*. In our research, *interest* is gathered under the type of task and the topics addressed. *Utility* involves posing the issue of whether there is anything more important than critical reflection and showing its goodness with results. A lot remains to be done in this field, although at least an important step in the right direction has been taken in recent years: the awareness of investigators of critical thinking that we should not only attend to skills but that we

should incorporate crucial dimensions such as the motivational, attitudinal or meta-knowledge dimensions.

We have described the main aspects of our intervention with the exception of one, which we have left for the end of this section. Since the start of our applied research some time ago we have observed that the teaching of Critical Thinking is *biased*: students are instructed in good reasoning but not in preventing poor reasoning. We shall thus spend a little time on this discrepancy aspect, which we believe to be a limitation. Some time ago, in 1988, Baron (2008) pointed out that in order to improve thinking processes three aspects must be tackled: the descriptive, the normative, and the prescriptive, but little attention has been paid to descriptive issues from the Critical Thinking approach.

It was precisely a psychologist (Henle, 1962) who performed some very interesting descriptive studies in which she pointed out how poorly we reason. Henle posed daily problems in which, as a general conclusion, she found that we scarcely use formal logic and that above all we use our *personal* logic. In other words, our beliefs, our way of understanding reality, mark the course of reasoning, without taking into account essential aspects such as the relationship between the different affirmations of an argument. What is most important about Henle's work is that it is the first descriptive investigation to address how we reflect, and hence to ascertain which systematic errors we commit. The pioneering aspect of this work is that it calls attention to the limitations of our judgements and how important it is to be aware of these deficiencies in order to correct them. From a normative point of view, it is assumed that the idea is to teach students how to think correctly, but not that such teaching is harder if the biases and deficiencies in our way of thinking are not known.

Some time ago, in 1985, Nickerson (2008) differentiated *reasoning* from *rationalizing*. In the idea of *rationalizing,* the author was referring to many of the fundamental biases or errors in reasoning that have been identified since the work of Henle. In our daily activities, when we check an idea or a hypothesis we normally only focus on the information or data that confirm it, but never on those that refute it. This *confirmatory bias*, for example, is one of the most important ones in what Nickerson refers to as *rationalization*. The problem with these distortions, or errors, is that they cannot be corrected or eliminated merely through the acquisition of correct reasoning skills. Nickerson suggests a powerful reason for this. There is a certain automatic nature or unconscious functioning in our way of thinking, as is the case of confirmatory thinking, such that, for example, it cannot be corrected through a mastery of the scientific method, since when this is applied we continue to pay no heed to non-confirmatory data and again fall into the trap. These errors can only be eliminated by our becoming aware of them; becoming familiar with this way of proceeding with a view to avoiding it. The same occurs with fallacies. These cannot be prevented merely by applying criteria of soundness; we must have some knowledge of them, because the language and the way in which such pseudo-arguments are expressed are so subtle that they are able to confuse us much more easily than we would wish. However, since the *errors or distortions* of our way of thinking cannot be avoided through good judgement *they must be incorporated into instruction*; i.e., they deserve separate treatment. As regards reasoning, as well as addressing the most common fallacies, we naturally look at the confirmatory bias (with all its implications) as well as the errors of illicit conversions with universal or conditional propositions. We also address the error of confusing truth with validity and the error of using inductive strategies in deductive contexts, to cite some of the biases taught in our program (see Evans, 2007; Govier, 2005; Saiz, 2002c; 2002d). In sum, what

we wish to show is the relevance of such descriptive issues in interventions and the need to incorporate them, as we are attempting to do here.

Having discussed the limitations of our thinking, we complete the description of the ARDESOS program. We have focused on the main pillars of the program: *a lot of practice, inter-domain practice, daily situations, and biases.* Procedural activity is a constant in all instruction initiatives and there is nothing new in incorporating a lot of practice in any program of this type. However, what is new is that those activities stem from different contexts, that they are posed as real problems, attending to the limitations of our minds to address them. This is because as far as we are aware such an approach has not been used previously. The aim of the present work is to check whether an intervention of this type will be efficient; that is, whether it will produce a reasonable improvement in Critical Thinking. Our final aim is to check whether such progress will become generalized. Our efforts are directed towards allowing the improvement in skills to be expressed in any personal or professional context. Let it not be forgotten that the tasks used in our interventions are simulated, suitably represented daily situations. If performance on them is good, it should also be good in reality, or at least we can hope that this will be the case, just as a flight simulator exercise is expected to provide the same responses as in a real airplane.

If our goal in this research is to develop our ability for critical reflection, it is because this ability is not manifested as much as it should be. We have already stated that when intellectual capacity is tested the results are much poorer than would be hoped for or expected. This is undoubtedly an important problem that merits future investigation. To achieve our aims, we developed the program described above (which we will detail in all its phases in the section addressing methodology) and we believe that this initiative has some features that could make it reasonably efficient. This is therefore our proposal for solving the limitations of or optimizing people's ability to engage in thinking properly. In simple words, our *working hypothesis* is that the performance of the participants in the ARDESOS program will be better than that of those who are not enrolled in it, but who nevertheless have received a classical instruction in thinking (based on decontextualized exercises of induction and deduction). Nevertheless, this must be confirmed, and to do so we carried out the study described in the following section.

II. Methodology.

A. Participants.

Initially we started out with a convenience sample of 199 students (85% women) from the fourth year of the Psychology degree at the University of Salamanca. As a control group, 114 students (84% women) from the fourth year of the Psychology degree at the University of Málaga were used. For different reasons (lack of information, incomplete tests, etc), the experimental loss was 22% in the intervention group and 18% in the control group. As a result, the final sample comprised 155 cases in the experimental group and 94 individuals in the control group. The equivalence of both groups as regards sex and age was analyzed. In the intervention group 84% were women while in the control group the figure was 87%. This difference is not statistically significant. ($\chi^2_{(1)}$=0.291; p=0.590). The mean of the individuals participating in the intervention was 22.77 years (s.d 1.09), while the corresponding age in the control group was 22.93 years (s.d. 1.20). This difference was not statistically significant either ($t_{(247)}$=1.06; p=0.289). Both tests confirmed the equivalence between groups with sufficient reliability.

B. Assessment materials and measurements.

PENCRISAL: test for the assessment of Critical Thinking skills.

As a measure of the magnitude of the effect of the intervention, and with a view to determining whether the intervention had afforded an improvement in Critical Thinking skills, the PENCRISAL test, explained below, was applied. A more detailed description of the test can be found in Saiz and Rivas (2008b).

PENCRISAL is a test comprising 35 problem-situation items offered in an open-response format. The statements are designed in such a way that they do not demand that the response should be elaborated and expressed in technical terms. Quite the opposite; they can be answered perfectly well in colloquial language. These 35 items are configured around 5 factors: deductive reasoning, inductive and practical reasoning, decision-making and problem-solving. In the distribution of the problem situations, in each factor the choice of the most representative structures of each of them was taken into account. These factors thus represent the fundamental skills of thinking and in each of them the most relevant forms of reflection and resolution in our daily functioning can be found. When PENCRISAL was applied, the order of presentation of the items was random, although care was taken to ensure that several situations belonging to the same factor would not appear consecutively.

PENCRISAL can be administered in written form or using a computerized version through the Internet. Also, it can be applied individually or collectively. In our study we chose the computerized, collective application owing to the advantages this offers. It offers the most advantages to the corrector by facilitating the tedious inputting of data, and all so for the person taking the test, since the programming system allows the test to be taken in several sessions, thereby reducing the possible effects of tiredness that it may elicit, especially as regards performance on the last items. The system also allows all the relevant aspects of the test to be controlled, such as preventing any item from not being answered, because the system will not pass to the next item until an answer has been given to the previous one, and preventing the subject from correcting previous answers or taking the test again once it has been completed. The Internet version allows students to take the test from any place where an Internet connection is available, such as at home. The collective administration, however, is carried out in a classroom with several computers (in our case, three classrooms with twenty computers each). The latter allows control over each of the subjects to ensure they are performing the test without any help, something that cannot be controlled when the test is taken alone, without supervision. We do believe these advantages are enough to choose the collective computerized application over the other possibilities.

The correction criteria used were established on the basis of three standard values:
0 points: when the answer given as the solution is **incorrect**.
1 point: when the solution is **correct,** but insufficient argumentation is given (the student only identifies and demonstrates an understanding of the basic concepts).
2 points: when as well as getting the correct answer the individual **justifies or explains** why s/he has arrived at that conclusion (where more complex processes involving real mechanisms of production are used).

Thus, a system of quantitative scaling was used, whose range of values was between 0 and 70 points as the maximum limit for the global score on the tests, and between 0 and 14 for each of the five scales.

Regarding the time during which the test should last, our test can be defined as a psychometric power test (addressing capacity); that is, with no limitation on time. Nevertheless, the mean duration estimated for completing the test is between 60 and 90 min.

Psychometric study of this scale was performed with the 313 university students described above. Factor analysis was used for construct validation. The conditions for its use were fulfilled satisfactorily (KMO=0.605 and p=0.000 in the Bartlett test). The results revealed a set of factors and subfactors that accounted for 59.35% of the variance. Most of the items (28; i.e., 80%) correctly demonstrated (with saturations > 0.500) that they belonged to the expected theoretical factors: 8 to the deductive factor; 4 to the inductive one; 7 to practical reasoning; 5 to decision making, and 4 to problem solving. Regarding reliability, this set of items attained an acceptable Cronbach alpha value (0.737; $p<0.05$). In general, the scale can be said to demonstrate its factor validity, and its reliability is satisfactory. Nevertheless, as a consequence of these observations, 7 items (20%) were modified or replaced by others and currently the second version of the test is in the validation phase.

C. Intervention program.

The aim of our investigation was to optimize the intellectual skills involved in Critical Thinking established above (*reasoning, problem solving,* and *decision making*).

Owing to the complexity of the skills addressed, the problem is only suitable for adult populations with at least an average intellectual level. Our work was carried out with university students since it was a convenient and available population.

Our intervention is designed for classroom application over 20-30 hours, distributed in 15-20 ninety-minute weekly sessions and a maximum time of 60 hours including the students' own work (see Appendix 1).

The name we used to designate this intervention is the "ARDESOS program for the development of Critical Thinking." This term covers the three large skills conforming our program -**AR**gumentation, **DE**cision and **So**lution- together with one of the main features of our intervention: the use of daily **S**ituations for the development of those skills.

The ARDESOS program is based on the direct teaching of thinking skills, since this type of instruction allows the transfer of knowledge; that is, teaching the skills that we wish to be mastered directly should allow them to be applied to any other context.

These skills are essentially procedural knowledge, and hence our intervention focuses more on process learning than on content learning. Contents are evidently necessary for all types of learning but these are rigid and static, while processes are flexible and allow us to create alternatives since each person can generate different ways to access the same information. These ways are transferable and, once acquired, they can be applied to any field of knowledge.

The teaching-learning strategy on which our intervention program is based is Problem-Based Learning (PBL). Activity revolves around the discussion of different problem situations designed in the program, and the learning of the skills of Critical Thinking arises from the experience of having worked with such situations. It is a method that stimulates metacognitive processes and allows students to practise by challenging them with real situations, where they must seek and investigate their own answers and solutions.

The ARDESOS program focuses on the teaching of skills that we consider to be essential for the development of Critical Thinking, and hence for good practices in people's daily activities. To do so, it is necessary to use reasoning and good strategies for solving problems and

making decisions. As explained in the Introduction, these three skills are the basis of our intervention. Nevertheless, it should be noted that the intervention involves not only instruction in the skills used daily but also correction of the biases and errors committed when they are used.

The main procedures used in the different activities of the program are reflection and discussion, active participation by students, and training in the different skills of Critical Thinking.

The tasks used in the program are a simulation of daily situations in which problems are posed that must be solved with the skills of reasoning, problem-solving and decision-making. These problem situations allow the differences between the learning contexts and daily life to be minimized.

Our program was applied to reduced groups of students (not as reduced as we would have wished, owing to our student numbers) of 15-20 persons. We consider that the ideal number of participants would be 10-12*,* but this is not always possible to achieve. The length of the program is approximately 60 hours, which are distributed as follows: fifteen 90-minute sessions with 15-20 students (23 hours), ten 90-minute lectures with 50 students (15 hours) and seven 1-hour tutorials with 3-5 students groups. The remaining 15 hours are devoted to the solving of daily problems, carried out in the students' own time.

The procedure is as follows. The instructor begins a process of direct teaching of each skill, applying it in a practical way to specific examples. The emphasis of the teaching of each skill is placed on in the structural aspects of the different arguments, such that study of each of them does not depend on the content but on the structure. One aspect meriting attention is that the students must solve a series of problems before each of the sessions. This allows more time for the sessions and, additionally, it allows the students to become aware of the difficulties and to understand why they can solve some problems but not others. This in turn makes them aware of their own limitations so that in the practical classes they can explore them further. Moreover, since the students must attempt to solve the problems before the sessions they can compare the process they have followed with that of other students and that offered by the instructor. In this way, on one hand we are fostering meta-knowledge and, on the other, we are increasing practical activities.

In each session, the aim is for the students to tackle the problem situations actively. Performance is subject to continuous assessment with a view to stimulating the students to complete the activities before the sessions, which is crucial for the success of the program owing to the few hours available for direct contact. In this sense, all participants later received a detailed analysis and assessment of their work. Additionally, the evaluation of student performance was completed with classroom discussion by the instructor of all the difficulties and doubts that had emerged and a clarification of such problems. As stated earlier, we wish the students to become aware of their own thought processes in order to improve them.

The sessions revolved homogeneously around blocks of skills. Within the field of reasoning, argumentation was the main issue. In order to find intellectual tasks that could be applied in daily situations, we used a general model of argumentation, such as that of Toulmin (2003), which is followed by most authors (see, among others, Fisher, 2002; Govier, 2005; Johnson & Blair, 2006; Walton, 2006). Our contribution as regards the model of argumentation was to include all the forms of reasoning we were going to use in teaching it. The proposal of most authors is to separate argumentation (informal reasoning) from other forms of reasoning. We believe that this separation is not valid in daily life. When people defend a given stance or position, they argue making use of all the inference resources that they are able to, even though

they are not aware of most of them. If we were to analyze argumentative texts produced by a person, different forms of reasoning would become apparent. The question that in due course emerged was that if in our daily use of reasoning we do not separate certain structures from others, since all of them are integrated in an argumentative text or discourse, why do this in instruction? Thus, we have developed a global focus about reasoning that has proved to be more efficient than studying the different types of argumentation separately. By using an integrated model, we facilitate the understanding and use of the different reasoning structures in any circumstance or situation. This allows us to achieve a better degree of skill in the domain of argumentation. The efforts to integrate these skills were also applied to decision-making and problem-solving. Here, within a general mechanism of problem solving we related and integrated the different decision strategies and the search for solutions. A large part of the materials used can be found at the following internet address:

http://www.pensamiento-critico.com/pensacono/prograpensa.htm#mat didac

D. Design.

In order to analyze the efficiency of the intervention, a quasi-experimental design was made of two groups with pre- and post-treatment measurements. The intervention (O_1 X O_2) and control (O_1-O_2) groups were formed and from these we first took a pre-treatment measurement. Then, after the program had been applied in the intervention group, we performed the post-treatment measurements.

E. Procedure.

Application of the ARDESOS program was carried out along one semester at the School of Psychology of the University of Salamanca. One week before the instruction we applied the PENCRISAL test to all the students (control and intervention groups) and one week after the end of the instruction the second measurement with PENCRISAL was implemented. The time elapsed between the pre- and post-treatment measurements was 4 months for both groups. The intervention was performed by a single instructor with good experience and training in the program.

F. Analysis of results.

To analyze the effect of the intervention, Student's *t* tests for independent samples with repeated measurements were implemented to check whether there were significant differences between the groups in the pre- and post- situations. Data treatment was accomplished using the SPPS package (v. 15.0).

III. Results.

As mentioned in the description of the PENCRISAL test, Critical Thinking was measured on the basis of five factors- Deduction, Induction, Practical Reasoning, decision-making (DM) and problem-solving (PS), and an overall score. Accordingly, the analysis was carried out attending to the performance observed on each of these 6 variables

First, we describe the results obtained in the *pre-post measurements in the control group.* As can be seen in table 1, no statistically significant differences were observed in four of the five factors of the scale: *deduction* ($t_{(79)}$=0.88; p=0.384), *induction* ($t_{(84)}$=0.00; p=1), *practical reasoning* ($t_{(81)}$=0.326; p=0.746) *and problem-solving* ($t_{(80)}$=0,00; p=1). Neither were there statistically significant differences in the overall scores of the test ($t_{(79)}$=1.25; p=0.218). Significant differences were only found for the *decision-making* factor ($t_{(81)}$=3.43; p=0.001), with a mean of 5.73 on the pre-test and of 4.73 on the post-test measurement, from which a decrease in performance over time can be deduced. These data indicate that in general terms the group not receiving the treatment did not alter their skills during the four-month period between both measurements.

Regarding the *intervention* group, evidently it was expected that the *pre-post* measures would differ significantly. In table 1 it can also be seen that in the intervention group statistically significant differences were only observed for three factors. In *induction* ($t_{(92)}$=3.84; p=0.000), mean performance was higher at post-test (M=4.69) than at pre-test (M=3.74); in *decision-making* ($t_{(86)}$=2.08; p=0.040), an increase in performance also occurred after the intervention (M_{pre}=6.08; M_{post}=6.64). However, the significance reached on the *deduction* factor ($t_{(89)}$=3.83; p=0.000) was in this case the opposite of what was expected (M_{pre}=6.31; M_{post}=5.21), indicating that the students' performance on this skill was worse after the intervention. No significant differences were seen for the practical reasoning factor ($t_{(92)}$=0.332; p=0.741) or problem-solving factor ($t_{(92)}$=1.51; p=0.135). Regarding the total PENSCRISAL score, no significant differences were observed either between the pre- and post-treatment measurements ($t_{(86)}$=0.76; p=0.448). Taken together, these data suggest that the intervention group improved on some of the factors after the program had been applied.

In table 2, we describe the *pre-test measurements obtained in both groups* to see whether both groups were similar in their initial state as regards the PENCRISAL variables. In particular, the data show that the groups did not differ significantly in the following factors: *deduction* ($t_{(229)}$=1.69; p=0.092), *induction* ($t_{(231)}$=1.90; p=0.058), *decision-making* ($t_{(236)}$=1.42; p=0.156) and *problem-solving* ($t_{(236)}$=0.96; p=0.337). In contrast, statistically significant differences were seen in *practical reasoning* skills ($t_{(230)}$=6.29; p=0.000) between both groups, the intervention group obtaining better scores (M=6.47) than the controls (M=4.24). This could account for the significant differences also seen in the total mean of PENCRISAL ($t_{(226)}$=2.67; p=0.008), where the intervention groups maintained a higher score (M_{INT}= 26.36; M_{CONT}=23.81).

Finally, we analyzed the size of the effect observed in the PENCRISAL score after the intervention program. To accomplish this, we compared *both groups* as regards their *post-test* scores. Statistically significant differences were observed in the total score ($t_{(177)}$=2.71; p=0.008), with a higher performance mean in the intervention groups than in the control (M=26.63 and M=23.70, respectively), and also in three of the factors of the scale (see 2). Specifically, performance on *practical reasoning* was significantly better ($t_{(183)}$=5.02; p=0.000) in the intervention group (M=6.62) than in the control group (M=4.52); and the *decision-making* skill also underwent a significant improvement ($t_{(178)}$=7.27; p=0.000) in the intervention group (M=6.58) with respect to the controls (M=4.62). Nonetheless, the results concerning deduction show that the control group (M=6.03) was the one whose performance regarding this skill improved ($t_{(184)}$=2.25; p=0.026) with respect to the group that received the instruction (M=5.29). Finally, no significant changes were observed in the other two factors of the test: *induction* ($t_{(192)}$=21.35; p=0.179) and *problem-solving* ($t_{(186)}$=1.81; p=0.072). These data indicate the

significant improvement due to the intervention in most of the factors with respect to the control group after application of the program.

Table 1. Means, standard deviations, and significance of the PENCRISAL measurements.

Comparison between pre-post-test measurements

	INTERVETION (n=155)			**CONTROL** (n=94)		
	PRE	POST	Difference	PRE	POST	Difference
	Mean (d.t.)	Mean (d.t.)	Dif. Between means p-sig n valid	Mean (d.t.)	Mean (d.t.)	Dif. Between means p-sig n valid
DED	6.31 (2.47)	5.21 (2.21)	1.10 ** **0.000** 97	5.97 (2.52)	6,32 (2.22)	-0,35 0.384 61
IND	3.74 (1.59)	4.69 2.20)	-0.95 ** **0.000** 99	4.49 (1.53)	4.49 (1.66)	0.00 1.00 72
RP	6.37 (2.69)	6.47 (2.74)	-0.10 0.741 97	4.42 (2.27)	4.53 (3.01)	-0.11 0.746 65
TD	6.08 (1.74)	6.64 (2.04)	-0.56 * **0.040** 88	5.73 (1.90)	4.73 (1.67)	1.00 ** **0.001** 63
SP	3.75 (1.32)	3.53 (1.23)	0.22 0.135 94	4.06 (1.21)	4.06 (1.39)	0.00 1.00 74
TOT	25.98 (6.27)	26.65 (7.35)	-0.67 0.448 70	24.69 (5.91)	23.36 (5.95)	1.33 0.218 55

* Significant at 5% ** Significant at 1%

IV. Discussion and implications for future research.

Overall, it can be said that the results obtained with our ARDESOS program indicate efficiency in some of the factors, as seen from the significant changes in the right direction. However, it seems appropriate to spend some time exploring these results further. One very important observation is that the control group obtained the same scores at pre- and post test. Had this not been the case, we would be unable to say anything about the improvements obtained with the intervention. However, with this equality we can be reasonably sure that the changes achieved in the intervention group at post-test must have been due to application of our program. Overall performance was higher at post-test in the intervention group, which is what was expected. In sum, we seem to have achieved the ideal situation with this type of design: no differences in the control group and differences in the intervention group as regards their performance at pre- and post test, the latter values being higher. Nonetheless, we failed to achieve an improvement in all the skills taught. An improvement was observed in induction and decision-making, but not in deduction. We have no clear explanation for this, although the following could be advanced. In this study, we used the first version of PENCRISAL, in which we later detected certain deficiencies in the items; these have now been corrected. One of them could have been responsible for the anomaly. The level of difficulty of the test was high as regards situations of

deduction. On working with the different types of reasoning with an integrated text, it is possible that -indirectly- more emphasis was being placed on seeking the elements of an argument, such as reasons and conclusions, than on formal structures. After the intervention, this -together with the difficulty of those items, could have led to a bias towards only argumentative forms (practical reasoning), sidestepping deductive forms too much. However, what we can explain is the improvement (although not significant) in deduction in the control group. This group received several hours of practice in deduction and a few practical sessions dealing with decision-making and induction. These activities clearly account for the improvement.

Another unexpected finding, which again we can account for, is the absence of before-after differences in practical reasoning. Application of the pre-post measurements was performed when the practical work in this area had already started, such that the gain on this factor was abolished by this lack of control. This is very patent in the measurements of the two groups. The intervention group started out from just over six (6.37) and the control groups from slightly more

Table 2. Means, standard deviations, and statistical significance of the PENCRISAL means.

Comparison between groups

	PRE-MEASUREMENT			**POST-MEASUREMENT**		
	Intervention (n=155)	Control (n=94)	Difference	Intervetion (n=155)	Control (n=94)	Difference
	Mean (d.t.) n valid	Mean (d.t.) n valid	Dif. Between means p-sig g.l.	Mean (d.t.) n valid	Mean (d.t.) n valid	Dif. Between means p-sig g.l.
DED	6,12 (2,41) 150	5,54 (2,56) 81	0,58 0,092 229	5,29 (2,30) 98	6,03 (2,22) 88	-0,74 * **0,026** 184
IND	3,88 (1,55) 149	4,29 (1,58) 84	-0,41 0,058 231	4,72 (2,27) 101	4,33 (1,68) 93	0,39 0,179 192
RP	6,47 (2,66) 147	4,24 (2,46) 85	2,23 ** **0,000** 230	6,62 (2,77) 99	4,52 (2,88) 86	2,10 ** **0,000** 183
TD	6,00 (1,88) 154	5,64 (1,79) 84	0,36 0,156 236	6,58 (2,00) 93	4,62 (1,57) 87	1,96 ** **0,000** 178
SP	3,77 (1,28) 155	3,94 (1,25) 84	-0,17 0,337 237	3,50 (1,25) 97	3,85 (1,40) 91	-0,35 0,072 186
TOT	26,36 (6,45) 124	23,81 (6,05) 67	2,55 ** **0,008** 189	26,63 (7,64) 82	23,70 (5,93) 80	2,93 ** **0,008** 160

* Significant at 5% ** Significant at 1%

than 4 (4.42). In the post- measurement, for the former we observed that this level persisted (6.47), as in the second case (4.53). However, it should be noted that that difference of two points between both groups is one third of the performance. If the intervention group had started out from four points, the difference would have been significant. Proof of this is that the mean between groups on the post- measurement was significant.

Neither did the students' performance on problem solving improve after the intervention. This would probably be due to the following reasons. Some problem-solving and decision-making items are general, and to be solved they demand procedures involving overall planning of the answer. It is possible that some interference might have arisen between both types of situation, preventing a treatment and differential solution for each of them. Finally, we failed to find significant differences between the groups on the post- measurements for induction. We believe that this can be explained in terms of the level of difficulty of those items, which produced the classic *floor effect*.

In our Critical Thinking evaluation test, we have detected a few limitations that need to be corrected. The first is its high level of difficulty. This characteristic might have prevented the detection of significant additional effects of the intervention. The difference in the number of items between some dimensions poses a second problem, and may affect the reliability of the test. These limitations, besides certain other minor problems, have been overcome in the current version of the test.

Globally, our program represents a very ambitious bet regarding the objectives it attempts to achieve. Such an instruction program requires a careful conceptual development and evolves along time as it achieves positive results. We are convinced that our intervention will provide these good results, but the path is still long. This work is the first to test the initiative and, as such, has yielded modest results; we are aware that these must be improved. We have indeed learnt a lot from what we have not achieved and we are currently putting our experience into practice and introducing modifications to the program. Our hope is to achieve a better efficiency in changing the skills of Critical Thinking, and we believe we are moving in the right direction.

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Collateral opportunity for increased faculty collaboration and development through a mentored critical thinking and writing exercise in a dental school curriculum

Terry E. Hoover, DDS[1] and Lucinda J. Lyon, DDS, EdD[2]

Abstract: This essay examines the collateral benefits to faculty from a guided learning literature review project for students. We describe a 3-year continuum of project creation and refinement designed to foster critical thinking and writing for second year dental students at the University of the Pacific Arthur A. Dugoni School of Dentistry. We discuss how this exercise suggested that a potential for faculty partnerships and increased interest in development could be derived through such a collaborative pedagogy. Finally we consider the value of such a mentored teaching and learning exercise as an intentional strategy for increasing the potential for new teaching, learning, and scholarly productivity beyond original acquaintances and disciplines as well as stimulating individual faculty desire for growth.

Keywords: peer mentoring, faculty development, collaborative learning, critical thinking

I. Introduction.

Pedagogy aimed at increased critical thinking and professional competency has been an element of graduate dental education for generations (Kewalin Thammasitboon, Sukotjo, Howell and Karimbux, 2007). How dental schools have historically attempted to strengthen the level of critical thinking among students and faculty has also been studied and discussed at length (Brunette, 2007; Chambers, 2009; Johnsen, Finkelstein, Marshall and Chalkley, 2009). In 2008, the American Dental Education Association (ADEA) adopted an updated set of *Competencies for the New General Dentist*. Critical thinking was featured prominently as one of the six specific domains around which these competencies were created. These guidelines state the need for dental school graduates to be able to "Evaluate and integrate best research outcomes with clinical expertise and patient values for evidence-based practice" (American Dental Education Association, 2008).

To help achieve these objectives, beginning in academic year 2008-2009, second year dental students at the University of the Pacific were given a critical thinking and writing assignment which extended over three academic quarters. They were to search peer reviewed healthcare literature on a selected topic; read and critically assess the information; identify information gaps, new applications, alternative perspectives or controversies involving the topic; formulate some conclusions; and write a short, original, referenced paper of 1500-2500 words describing their findings.

[1] University of the Pacific, Arthur A. Dugoni School of Dentistry, 2155 Webster Street, San Francisco, CA 94115, thoover@pacific.edu.
[2] University of the Pacific, Arthur A. Dugoni School of Dentistry, San Francisco, clyon@ pacific.edu

One-on-one faculty mentorships were created to enhance this guided learning experience. Each student was matched with a faculty mentor who would support them through the assignment. Mentors provided broad topics in which they had experience or expertise; were currently conducting research; or were interested in exploring. In the spirit of the ADEA President's Commission on Mentoring, faculty mentoring was done on a voluntary basis, outside formal teaching commitments (Friedman, Arena, Atchison, Beemsterboer, Farsai, Giusti, Haden, Martin, Sanders, Sudzina, Tedesco, Williams, Zinser, Valachovic, Mintz and Sandmeyer, 2004).

A diverse group of faculty were recruited to these mentorships. These educators were of varying rank; didactic, clinical, and research focused; from specialty disciplines as well as general dentistry; and novice to very experienced teachers. As word of this exercise spread through our institution, the cohort of participating faculty mentors increased greatly in the next two successive years. Department chairs began to direct new faculty toward these mentorships as an opportunity for early involvement in scholarship and student mentoring. Faculty participants as well began to request additional development in searching for peer-evaluated literature and scholarly writing.

These collateral benefits of faculty collaboration and increased desire for development opportunities led the authors to explore these phenomena further by asking the questions: 1.) can faculty participation in a collaborative guided learning project provide a platform for increased collaboration in additional new teaching, learning, and scholarly projects; and 2.) can skills learned in support of such an experiential exercise be a vehicle for faculty development in a more strategic way?

II. Background.

A. Guided Learning – Literature Review Assignment, and Outcomes.

The following were among the goals for the first year of the literature review exercise (AY 2008-2009): to create a critical thinking assignment for second year dental students; raise students' awareness of scholarship through faculty mentorship and role modeling; and increase participation of faculty from diverse backgrounds in this multi-disciplinary course. Specific student learning objectives were stated in the Literature Review Project Syllabus as follows: "…to demonstrate your ability to do literature research on a selected topic, critically assess the information, and write a short original paper on that topic… you will need to master scientific journal searches as well as develop and use critical thinking skills to synthesize an original paper…[this project] will aid you in your professional career whether that includes engaging in primary research or reading, understanding and critically assessing research by others in your quest as a lifelong learner and oral health care professional" (see Appendix 1).

Students were given presentations, exercises, or reference material that strengthened the skills required to complete this project. They were introduced to the importance of utilizing scholarly resources. To support this task, a university research librarian led students, and interested faculty, through a workshop on how to locate, access, and appraise information from various peer reviewed data bases. An experienced faculty researcher also offered a seminar on reading and critically assessing scientific literature. Students were provided information on writing, formatting, and referencing their manuscript, including how to present clear positions and arguments to demonstrate their knowledge and understanding of the chosen topic.

Librarians were generously available to provide suggestions and access to resources which students were not initially able to retrieve independently. Students were encouraged to meet often with their faculty mentors. Mentor support was particularly helpful to students in narrowing the focus of their topic and searches. The course director advised and supported both students and faculty mentors with questions and feedback about the assignment.

Completed papers were not given a letter grade, but evaluated for process in literature search, critical thinking, formatting, referencing, and personal conclusions. Each faculty mentor was responsible to evaluate the work of their student(s) and work with them until the paper was complete and met acceptable outcomes.

Faculty and the course director met during, and at the conclusion of each project iteration, to debrief, share feedback, and calibrate on issues such as expected scholarship in final papers and appropriate level of faculty assistance. Formative and summative outcomes for the exercise were assessed. Improvements implemented included: lowering the student to faculty mentor ratio; sharing of exemplary papers; rewarding exceptional scholarship with an opportunity to present findings; and extra credit toward final course grade.

Participating faculty mentors were recognized for their generous volunteer commitment with acknowledgement letters for inclusion in their promotion and tenure dossiers; luncheons where they were asked to share input and ideas to shape and improve the exercise; and public acknowledgement by the course director and academic dean. Additionally, details of this project have been presented to professional organizations as an example of cross-disciplinary collaboration. It should be stressed that recognition of mentor contributions should be a permanent element of this ongoing mentoring experience.

B. Coincidental Faculty Collaboration and Development Opportunities.

A number of less formal collateral benefits related to faculty participation began to emerge in successive project years. The cohort of participating faculty mentors grew from forty-three in the initial year of the assignment, to fifty-nine, then eighty in the next two successive years. Many faculty and students reported that their interaction and collaboration would likely extend beyond the assignment. Three student/mentor teams developed their projects further and published their manuscripts. Several teams are presenting posters, for which their literature search played a role, at national meetings. Three additional teams plan on submittals for publication. Finally, several teams advised that they planned to cooperate on additional scholarship projects.

Faculty who worked in dissimilar disciplines became better acquainted with each other and their respective work through this shared project. Some agreed to opportunities to present material in cross-discipline integrated format. Participants with research and specialty backgrounds shared best practices for scholarly information search and manuscript preparation with less experienced faculty. Most understood and valued the varied expertise present in the school in a greater way.

Department Chairs referred new faculty to participate, citing the opportunity for informal interaction and discussion with a diverse group of peers in a low stakes environment; the chance to increase their personal scholarship; develop mentoring skill; and experience, firsthand, student capabilities in this specific area.

These coincidental outcomes prompted an exploration of the learning theory supporting such results and how a like teaching and learning project might be designed to intentionally support these ends.

III. Theoretical Framework.

In introducing a process for faculty to come together on this common project, it appears that a strong collaborative learning environment was coincidentally created for participants. Among the principles that the ADEA Commission on Change and Innovation (CCI) believes should "characterize the educational environment and inform dental curricula" are critical thinking; life-long and self-directed learning; a humanistic environment; and scientific discovery and the integration of knowledge (Haden, et al., 2006). These tenets appeared to have been engaged in the collective shaping of this literature review teaching and learning experience.

In the way that this diverse group came together around a common project, the collaborative learning environment is one in which participants of various perspectives and performance levels work together toward a common goal, solution, or product. Rather than being the primary font of information, teachers, using this approach, act as learning facilitators. All members of the community contribute to one another's learning (Gokhale, 1995; Smith & MacGregor, 1992). Gokhale's research specifically concludes that, through discussion, clarification of ideas and evaluation of others' thoughts, critical thinking is developed (1995), as was the case in this exercise.

Another methodology, action-learning, is also representative of the collaboration around this project by "creating a safe environment, encouraging openness, exploration, creativity, mutual respect and shared problem solving" (Kesby, 2008). Action learning has among its attributes the potential to: enhance team work and collaboration; build mutually beneficial and respectful relationships with colleagues; enhance participants' ability to learn from individual and collective experiences; increase participant capacity to discuss other organizational challenges; and to contribute to development of more novice participants (Kesby, 2008). Coincidentally, the course director facilitated such an environment of practical collaboration.

Learning was active, purposeful, and faculty enjoyed the chance to build on their varying levels of knowledge and skills to refine this specific curricular piece (Dreyfus & Dreyfus, 1986). The shared project produced intellectual synergy … "and the social stimulation of mutual engagement in a common endeavor" (Gokhale, 1995). Faculty mentors were faced with portions of the assignment that succeeded as planned and others that needed refinement. This modification appeared to be a pleasurable, collegial charge. Those with greater experience contributed not only to the success of the project, but also to the ability of those less experienced.

Similar to the ADEA CCI's foundational values noted above, North Carolina State University, in their university-wide framework for curricular integration, adopted four overarching intended learning outcomes: critical thinking, habits of independent inquiry, responsibility for one's own learning, and intellectual growth and maturity (Lee & Ash, 2010). Qualitative outcomes from their initiative confirmed that "being a member of a community of practice enhanced support for engaging in the scholarship of teaching and learning" (Lee & Ash, 2010, p. 44). Participants in this University of the Pacific experience voiced like appreciation for the collaborative environment.

Contributing to this synergy were the important mentoring qualities shared by the course director and senior faculty involved. Enlisting high profile mentors in the first cohort of mentors proved helpful. Among these were the dental school dean emeritus, the academic dean, and ten department chairs. In the spirit of effective mentors, these specific contributors provided resources, nurtured skill development, cultivated decision-making, enhanced self-confidence, and modeled enjoyment of the task for both students and less experienced faculty (Schrubbe,

2004). They additionally shared praise broadly for the resulting success of the exercise. In short, they made it easy and enjoyable to participate and they helped guide the group to effective outcomes. The benefit of such mentorship to perceived satisfaction of academic life are corroborated by Schrubbe (2004) who found the influence of role models and mentors to be both positive and important.

IV. Methodology.

A. Participants.

This reflective essay describes the experience of three cohorts of faculty participating in a guided literature review project for 2nd year dental students. This teaching and learning exercise has been offered twice to completion and is currently in-progress for its third implementation cycle.

Forty-three faculty volunteered to participate as mentors in the 2008-09 cycle; fifty-nine in the 2009-10 cycle and eighty in the 2010-11 cycle. The faculty included full-time, part-time, salaried, and adjunct faculty, all in varying stages of their teaching careers. Participants hailed from a number of disciplines with varied primary focus in research, didactic and clinical teaching. All teach or research in a graduate, professional school setting and, in this case, worked with graduate dental students (see Table 1).

Table 1. Faculty Mentor Demographic Data by Year of Student Lit Review Assignment.

Year	# Mentors	Prof	Assoc Prof	< Assoc Prof	Clinical Appt Component	Gen Dentist	Dental Spec	<10 Yrs Teaching
Year 1 (08-09)	43	14	8	21	30	19	13	16
Year 2 (09-10)	59	18	10	31	42	24	21	26
Year 3 (10-11)	80	20	15	45	61	38	26	39

B. Instruments.

Upon completion of the first year of this exercise, the course director sought feedback from participating faculty and students. Feedback was anecdotal and unstructured in the form of personal conversation or e-mail, which was logged by an administrative assistant. Comments reflected both positive outcomes and areas in need of improvement.

The second iteration of the literature review exercise was completed June, 2010. A more robust collection of feedback was sought. Along with a log of direct e-mail and anecdotal comments from faculty and students, an in-person group conference of mentors was held to debrief, solicit feedback, and discuss outcomes. In addition to transcribing oral feedback from this discussion, faculty shared additional information via a written survey (see Appendix 2).

C. Evaluation Procedures.

Qualitative data gathered from logged information and written surveys was coded to identify and categorize segments of data. Data was analyzed for identification of common themes. A summary of findings was created.

V. Findings.

We are now in the third iteration of this mentored literature review exercise. For each of the first two years the course director sought feedback from faculty and students on perceptions of this exercise and its outcomes. Findings are described below.

Qualitative data was coded by categories that expressed positive support or recommended changes. Subcategories, listed to the right, are in descending order from most mentioned to least mentioned (see Table 2).

Table 2. Qualitative Feedback by Year by Year of Student Lit Review Assignment

Year 1	Comments
Positive Support	*a. provides one-on-one interaction between student and faculty* *b. valuable exercise for student and mentor* *c. stresses importance of critical thinking and life-long learning for a professional* *d. opportunity to role model critical thinking, scientific method /scholarly writing* *e. humanistic, collegial atmosphere of school reinforced* *f. faculty willingness to volunteer time/expertise demonstrated*
Recommended Changes	*a. fewer students per mentor* *b. more frequent interaction between students and mentors* *c. more choice of topics by students* *d. incentives to improve level of scholarship* *e. better understanding by students of goals of assignment*
Year 2	Comments
Positive Support	*a. possibility of more publications* *b. more interaction & collaboration between faculty of different disciplines* *c. forces faculty to strengthen research and scholarship skills* *d. builds self confidence/self esteem/communication skills within students* *e. stresses importance of critical thinking and scholarship for a professional*
Recommended Changes	*a. more frequent interaction between students and mentors* *b. provide workshop on library searches, review of scientific writing* *c. experienced mentors guiding new mentors (peer mentoring)* *d. increase scholarly submissions for publication, thus raising the bar for students* *e. development of critical thinking assessment tools to be used school wide* *f. public discourse/student defense of their topics based on the evidence* *g. provide students training in presentation skills to display/present work*

Faculty feedback was generally positive regarding the interaction between students and faculty mentors, as a valuable learning exercise for both. There was positive support

demonstrated for the process and spirit of the mentorships as well as the learning objectives achieved.

Identified shortcomings took the form of suggestions for mechanical and technical improvements in the assignment such as fewer students per mentor, more consistent frequency of student/mentor interaction, more choice of topics by students, incentives for excellent work to improve level of scholarship, and better understanding by the students of the goal of the assignment (i.e. improving their critical thinking and writing skills).

The positive level of support for this assignment was strong enough to justify its continuation. Through a collaborative process of reflection; formative and summative outcomes assessment; and suggestions for refinements; important modifications were made.

Following year two of this exercise, the authors' noted an interesting change in the focus of the feedback in these responses. Suggestions changed from a focus on the technical details of the assignment itself to comments on the value of this exercise for faculty mentors, as well as ways to enhance it as a faculty development tool. They included such things as: requests for workshops on library searches; review of scientific writing; and request for experienced faculty mentors to guide newer mentors through the process (peer mentoring).

There were comments that this literature exercise encouraged faculty to strengthen their own personal skills in the scientific method in order to properly mentor students. Faculty expressed that interaction with colleagues from different disciplines during feedback sessions, workshops, and presentations provided potential for increased collaborations. There was also a focus on improving the quality of scholarship produced by this exercise with several faculty suggesting that the goal of the assignment should be scholarly publication. A number of faculty noted that collaboration with their students would likely extend beyond the assignment with plans to cooperate on additional scholarship projects.

The year two written survey also asked mentor respondents to rate the overall value of this assignment. Mentors were asked the value of this assignment to students on a 1 to 5 scale with "1" being of little value and "5" being very valuable. This rating averaged "4.4". Mentors rated the value of the assignment to faculty mentors using the same scale. The rating averaged "4.2". The responses are displayed in Table 3. The authors were aware of the general appreciation of the value of this exercise to students but the value to mentors rated high as well. The constructive suggestions previously mentioned illustrated the interest in strengthening the value of the exercise to mentors.

Table 3. Value Rating of Lit Review Project from Faculty Mentor Surveys.

Mentor Rating as Value to Student	**1**	**2**	**3**	**4**	**4.5**	**5**	**Avg.**
Number of Mentor Responses	*0*	*2*	*1*	*6*	*1*	*15*	*4.4*
Mentor Rating as Value to Mentor	**1**	**2**	**3**	**4**	**4.5**	**5**	**Avg.**
Number of Mentor Responses	*0*	*2*	*1*	*10*	*1*	*10*	*4.2*

As we begin year three of the Literature Review Project, a gradual demographic change to the faculty mentor ranks has been noted as the number of volunteer mentors has grown. As additional mentors have volunteered each year (43 mentors first year, 59 mentors second year, 80 this current year), the most recent mentors tend to be newer educators and more junior in rank. Five department chairs have actually referred new faculty as mentors, citing this as an opportunity to increase their involvement in scholarship, to mentor students, and to experience firsthand the level of student capability. This increased percentage of newer, less experienced faculty joining our mentor ranks may be contributing to the interest in faculty development resources (see Table 4).

Table 4. Faculty Mentor Demographic Analysis by Year of Student Lit Review Assignment.

Year	Year 1 (2008-2009)	Year 2 (2009-2010)	Year 3 (2010-2011)
Percentage Mentors with Clinical Teaching Component to Appointment	*70%*	*71%*	*76%*
Percentage Mentors with Less than 10 Years Teaching Experience	*37%*	*44%*	*49%*
Percentage Mentors with Academic Rank below Associate Professor	*49%*	*53%*	*56%*
Percentage Mentors with Academic Rank below Full Professor	*67%*	*71%*	*75%*
Percentage Dentist Mentors Who Are Non-Specialists	*59%*	*53%*	*59%*

VI. Conclusion.

Participants agreed that the critical thinking skills students practiced in this assignment will be valuable in their careers as lifelong learners and dental professionals. The student/faculty mentorship described provided learners an introductory scholarship experience in which some might not otherwise have participated. The exercise described demonstrates how a dental school, or any educational institution, can leverage the expertise of a diverse faculty to support student learning.

A brief discussion of the course director's approach to attracting committed faculty mentor volunteers may be valuable to educators wishing to create a similar teaching and learning experience. Virtually all faculty in higher education juggle a full schedule of teaching, scholarship, and service commitments. Therefore, enlisting volunteer mentors required a strong plan including project preparation; individual faculty engagement; demonstration of the teaching and learning value of the exercise; and participant recognition. Although personal invitation and

recruiting was a necessity in developing the first mentor cohort, attracting additional mentors occurred much more easily in succeeding years as a result of increased project visibility, mentor recognition, and participant enthusiasm.

As mentioned previously, critical thinking and writing exercises such as this are not unique to dental education. Perhaps the project outcomes of most interest and significance were the resulting faculty experiences, specifically in the areas of increased collaboration and desire for development. In this case, the process of working collectively enhanced collegial relationships and the potential for new teaching, learning, and scholarly productivity beyond original acquaintances and disciplines.

Mentor feedback seems to confirm the ADEA President's Commission on Mentoring benefits of mentoring for the mentor: increased personal satisfaction; opportunity for intellectual engagement and stimulation; opportunity to stay abreast of new knowledge and techniques; opportunity to "give back" by sharing expertise and knowledge; increased ability to attract collaborators for current and future projects; and an opportunity to "create a legacy" by helping to prepare the next generation (Friedman, et al., 2004).

Faculty seized on the opportunity to improve their skills in the scientific method. There was a collective desire to improve the ability to guide student learning through one on one mentorships. In addition to senior, more experienced faculty, generously mentoring less experienced peers, faculty requested additional, more formal support. This motivation provided a positive springboard for faculty development.

Finally, this experience demonstrates that a teaching innovation requires regular feedback and reflection to grow and thrive. In addition to planned student learning outcomes, coincidental, collateral faculty dynamics and opportunities may arise. To that end this faculty mentored critical thinking and writing exercise at the University of the Pacific Arthur A. Dugoni School of Dentistry will continue to evolve and might correctly be designated "a work in progress."

Appendices

Appendix 1. Literature Review Project Syllabus (Revised 3.21.2011)

http://www.dental.pacific.edu/Documents/microsites/acad_affairs/LiteratureReviewProjectSyllabus.pdf

Appendix 2. Faculty Mentor Survey (July 2010)

The purpose of this survey is to get feedback on the value of this student assignment and seek faculty suggestions on ways to improve student learning and the level of scholarship students produce.

1. Have you mentored a student(s) previously for this assignment?

   ☐ Yes

   ☐ No—this is my first year as a mentor

2. Rate the value of this project as a learning experience for students:

   (Of little value) 1-------2------3------4------5 (Very valuable)

   (circle choice)

3. Please make suggestions as to how the student learning experience could be improved:

4. Rate the value of this experience for faculty mentors:

   (Of little value) 1-------2------3------4------5 (Very valuable)

   (circle choice)

5. How could this experience be improved for the mentors?

6. Please list any benefits to any of the stakeholders (students, mentors, the school itself) beyond the learning event itself:

7. If you are an experienced mentor or have mentored students previously, would you be willing to coach or support faculty new to this student assignment?

   If **YES**, give your name _____

8. Are there additional resources that the course director and administrators could offer to students and mentors to facilitate this project?

9. Other comments about this assignment:

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Why can't we be friends? Using music to teach social justice

Denise L. Levy[1] and Daniel C. Byrd[2]

Abstract: Listening to music is an emotional and educational experience that has the potential to shape an individual's values, actions, and worldview. Widely used in elementary education, music can also be a fresh, innovative teaching tool in higher education. Although it can be applied to virtually any subject area, critical reflection and discussion of music can especially complement courses related to the concept of social justice. This paper provides a review of the literature on using music to teach justice-related concepts, an illustration of ways in which the authors have utilized music in their own courses, and conclusions for educators.

Keywords: culture, diversity, music, pedagogy

Music is a world within itself with a language we all understand, with an equal opportunity for all to sing, dance, and clap their hands. – Stevie Wonder

If there is something to be changed in this world, then it can only happen through music. – Jimi Hendrix

The average person under 18 years old spends 6.5 hours per day listening to or interacting with media (Cahill, 2008). Listening to music is an emotional and educational experience that potentially shapes an individual's values, actions, and worldview. At all levels of education teachers can utilize music to expose students to diverse cultures. Furthermore, instructors can challenge students to critically analyze and deconstruct lyrics both within a historical context and as applied to current social problems. "Whether it's songs of war or peace, music fuses the emotion and logic in a way that moves humans" (Seattle Post-Intelligencer Editorial Board, 2003, para.7). In essence, music can be a fresh, innovative teaching tool that inspires students at every level of education and across many different disciplines. As demonstrated in this paper, music can especially complement courses related to the concept of social justice. Social justice, according to Rawls (1999), is "the basic structure of society, or more exactly, the way in which the major social institutions distribute fundamental rights and duties and determine the division of advantages from social cooperation" (p. 6). Song lyrics often include ideas related to social justice such as accepting others, challenging discrimination, examining privilege, and rejecting violence. For instance, the WAR song "Why Can't We Be Friends?" questions why some people only befriend others who are in similar social groups. Although there are many different aspects of music that may relate to social justice, this article will focus solely on song lyrics and will not include a discussion of tempo, rhythm, mood, and so forth. The purpose of this paper is to provide a review of the literature on using music to teach justice-related concepts; a detailed illustration of ways in which the authors have utilized music in their own counseling, social studies, education, and social work courses; and conclusions for educators.

[1] Appalachian State University, Department of Social Work, ASU Box 32155, Boone, North Carolina 28608, levydl@appstate.edu.
[2] University of Georgia, Department of Elementary and Social Studies Education, 629 Aderhold Hall, Athens, Georgia 30602, dbyrd@uga.edu.

I. Review of the Literature.

Teachers and professors utilize popular music in teaching many different subjects, including writing or composition, cultural diversity, sociology, social studies, and social justice. In this review we will highlight literature on the use of music in elementary, middle, and high schools as well as in higher education.

A. Elementary and Middle School.

In elementary and middle schools, teachers often use music as a medium for teaching. Music teachers may employ music in order to prepare students for "lifelong musical as well as knowledgeable participation in a democratic society" (DeLorenzo, 2003, p. 26). On the other hand, non-music teachers may utilize music in teaching specific subjects like math, English, and social studies. For example, Elvis Presley Enterprises (2009) provided an online lesson plan to teach students "about the life of Elvis Presley and how he overcame poverty … [and] the importance of setting their own goals and dreams" (p. 1). The plan includes listening to two of Elvis' songs, *Confidence* and *If I Can Dream*, and analyzing the lyrics for messages about setting goals. Additionally, students may write reflective papers about their own dreams or about a time in which they set and accomplished a goal. Finally, middle school counselors may utilize music and song lyrics when teaching life skills such as problem solving (Vines, 2005).

B. High School.

White and McCormack (2006) explained that "over the course of students' years in school, the use of music in the classroom diminishes until it is almost nonexistent in the upper-level classrooms" (p. 125). However, they proposed that music has a definite application to the secondary education, social studies classroom. According to their article, older music can enhance understanding of history and contemporary songs can assist students in critically examining societal problems like "poverty, racism, abuse, and addictions and such global issues as hunger, disease, and war" (White & McCormack, p. 122). Similar to White and McCormack, Stovall (2006) encouraged the use of hip-hop song lyrics for high school courses in humanities and the social sciences, and specifically for social studies classes. Lane (n.d.) suggested the use of rock and roll songs in teaching social studies, and maintained that lessons which utilize rock:

> 1) build critical thinking skills, 2) deal with social issues and historical happenings, 3) can be used as documents to be studied, 4) are interdisciplinary by their very nature, 5) contextualize art and music by placing them in a societal context, 6) teach artistic appreciation for a more complex art form than usually thought, 7) are highly motivational, engaging, and accessible for the students and 8) . . . will be remembered far longer by most students than lessons crafted in a more traditional mode. (Advantages of Using Rock and Roll section, para. 1)

The use of music to build critical thinking skills, as mentioned by Lane, is not limited to high school. This can also occur in higher education as instructors encourage students "to think—by examining, evaluating, and challenging the assumptions, premises, interpretations, and evidence that others have taken for granted" (Royse, 2001, p. 45).

C. Higher Education.

In addition to elementary and middle school teachers, instructors from many different disciplines use music in higher education classrooms to illustrate various concepts. Specifically, literature highlights four subject areas: composition, Black history, helping professions, and sociology.

Composition. According to McParland (2009), "popular songs are socially produced forms of discourse that can stir students toward writing" (p. 101). In his composition course, college students explored issues such as culture and diversity through song lyrics. Starting with a familiar text made students feel more comfortable in exercising their own critical thinking abilities. In their analysis, both the lyrics and the music itself provided students with rich material for discussion.

Black history. In 1979, Cooper discussed popular music as a previously untapped resource for teaching contemporary Black history. The oral history dictated through African American music, according to Cooper, provides rich and dynamic material for learning. Further, it assists students in understanding the experience of African Americans throughout various points in history.

Helping professions. Incorporating music into counseling, nursing, and human service courses seems natural given the therapeutic nature of music. Literature describing the use of music in these courses focuses in teaching students how to incorporate music into their therapeutic work with clients. For instance, Ohrt, Foster, Hutchinson, and Ieva (2009) describe how music, videos, and film can assist counseling students in developing empathy. They explain that having students read lyrics, watch music videos, reflect, and process their experiences can assist them in understanding the lives of others who are very different from themselves.

In addition to assisting students in developing empathy, counseling programs teach students how to use music therapeutically with clients. Bradley, Whiting, Hendricks, Parr, and Jones (2008) describe how counselors can play music during counseling sessions and encourage clients to share "thoughts and feelings evoked by the song's rhythm and lyrics" (p. 51). Research indicates that music therapy can be useful for clients experiencing autism, addiction, physical pain, and grief, to name a few (Duffey, Somody, & Clifford, 2006/2007; Haberstroh, 2005; Lim, & Locsin, 2006; Siedliecki, & Good, 2006; Silverman, 2008). Exposing counseling students to music therapy content, and perhaps demonstrating these techniques in the higher education classroom, will encourage students to incorporate music into their own practice.

Sociology. Four articles specifically discuss using popular music to teach sociological theories and concepts in higher education (Ahlkvist, 1999; Albers, & Bach, 2003; Martinez, 1994; Walczak, & Reuter, 1994). In the first article, Walczak and Reuter (1994) reported on the effectiveness of song-lyric packets in teaching an introductory sociology course. Their study was based on 23 non-major students ranging in age from 19 to 46 and included 12 men and 11 women. The song-lyric packets provided to students were divided by topic and included a brief introduction, several learning objectives, song choices, and questions for discussion. Although students favored the use of music and song lyrics and overwhelmingly believed that the lyrics made it easier to understand particular sociological concepts, some students explained that they "did not like the recording artist" (p. 267) or thought the music was too outdated or did not include enough variety. Overall, students "found the use of music in the classroom to be a refreshing, relevant, entertaining, thought-provoking, and effective way to learn sociology" (Walczak, & Reuter, 1994, p. 267).

Included in the same journal issue as the previous study, Martinez (1994) discussed the use of popular music as a teaching tool in a specific sociology course, *Race, Class, and Gender.* Through music, she was able "to foster class discussion, to create a unique environment for learning, and to make students questions assumptions about themselves and others" (p. 263). In addition to incorporating song lyrics into theoretical discourse on prejudice and discrimination, Martinez asked students to focus on specific themes related to race, class and gender found in the selected music. Related to social justice, these three concepts provide a forum in which students can examine notions of privilege and discrimination in their own lives and in society.

Likewise, Ahlkvist (1999) explained that "music offers students the chance to harness concepts, theories, and research findings to analyze cultural objects, much like a cultural sociologist" (p. 126). Rather than solely using music to demonstrate certain theories or concepts, Ahlkvist proposed that instructors challenge students to actively analyze the music itself. This cultural analysis of music is not limited to the lyrics themselves, but can also include the CD or record covers, the typical or average fan of the music genre, and the historical and socio-political context in which songs were released. In the introductory sociology classes described in this article, students explored heavy metal music for themes related to Marxism and Durkheimian traditions; discussed sociological concepts such as masculinity, power, and toughness revealed in heavy metal music; analyzed symbols used in the heavy metal culture; and created a sociological profile of a heavy metal fan.

Finally, Albers and Bach (2003) reported on their experience of playing music in the 5 to 10 minutes prior to each class meeting of a large, introductory sociology course. They encouraged students to question the song choice and make their own connections between particular songs and subsequent course content. Additionally, Albers and Bach allowed students to select the music for the second half of the semester, further engaging the students in this process. Although the instructors played music before the class started, students reported that it made them more comfortable and enhanced their learning. In retrospect, Albers and Back explained that they could have enhanced the experience by displaying or providing the song lyrics.

II. Social Justice Across Genres, Artists, and Lyrics.

Instructors can utilize many different components of music to teach concepts of social justice. First, song lyrics can provide text for analysis and discussion. Appendix 1 includes a beginning list of a variety of songs with lyrics related to social justice. Included in the Appendix are lists of the main topics covered in each song. The subjects covered in these lyrics range from war and peace to poverty and discrimination. For example, in the song Why Can't We Be Friends, the band WAR refers to discrimination based on race when they sing that "*the color of your skin don't matter to me as long as we can live in harmony. Why can't we be friends?*" Similarly, in the song Everyday People, Sly and the Family Stone sing about acceptance of all people despite differences:

There is a blue one who can't accept the green one
For living with a fat one trying to be a skinny one
And different strokes for different folks
And so on and so on and

We got to live together
I am no better and neither are you
We are the same whatever we do

This short passage can provide a starting point for discussion about accepting and living in harmony with all people. Further, it encourages students to examine privilege and consider that no one person is better or more deserving than another based on identity traits such as race or size. A final example, Man in the Mirror by Michael Jackson, encourages students to consider what they can do to work toward a more just society. Jackson sings:

I'm starting with the man in the mirror
I'm asking him to change his ways
And no message could have been any clearer
If you wanna make the world a better place
Take a look at yourself and then make a change

The lyrics provided here are just brief glimpses into the vast amount of material that instructors can draw from to teach concepts of social justice.

In addition to song lyrics, instructors may utilize diverse genres of music in order to teach concepts of social justice. According to White and McCormack (2006),

> Many people are under the assumption that social commentary in music reached its pinnacle in the late sixties and early seventies. Founded in the eighties, punk, hip-hop, rap, grunge, and alternative are music genres that continue to provide considerable social commentary and historical references. (p. 123)

Instructors may find that students hold stereotypes about certain genres of music, and exposing them to a variety of music can challenge them and enrich their learning experiences. Appendix 1 includes songs from genres such as country, hip-hop, reggae, oldies, rap, classic rock, and so on, and we are constantly looking for music that spans other genres, such as classical compositions. However, instructors are cautioned to purposefully and thoughtfully select songs that will provide the most meaningful discourse rather than solely trying to incorporate varied musical genres (Cooper, 1979).

Along with diverse musical genres, instructors can select singers and songwriters with diverse backgrounds in order to highlight different experiences and worldviews. The use of popular music can "bring experiences and voices other than the teacher's into the classroom" (McParland, 2009, p. 102). Furthermore, it "opens up our awareness of difference and our recognition of similar universal themes and experiences among us" (McParland, 2009, p. 106). For example, instructors can utilize diverse artists such as Dolly Parton, the Beastie Boys, and Michael Jackson.

Finally, the time period in which songs were written can provide historical significance to the song lyrics. It is important for students to be able to understand the context in which songs were composed and be able to apply the lyrical concepts to various points throughout history. For example, Elvis Presley's If I Can Dream and Sly and the Family Stone's Everyday People were both released in 1968. In this historical year Martin Luther King Jr. was assassinated and riots broke out across the country in over 140 cities, Robert F. Kennedy was assassinated, countless individuals died in the Vietnam War, the war divided the country, Lyndon Johnson announced that he would not run for another term as president, protesters at the Democratic National Convention in Chicago were mobbed by police, the Women's Liberation Front protested the Atlantic City Miss America pageant, and Nixon was elected president (Knauer, 2008). Knowing about the political climate in which these two songs were written can certainly

influence how students think about song lyrics. Suddenly, in the context of the Vietnam War and race riots, Elvis singing "*If I can dream of a better land where all my brothers walk hand in hand, tell me why, oh why, oh why cant my dream come true?*" has a deeper meaning.

III. Classroom Examples.

In a University social work course on cultural diversity, the first author, Levy, played one song per week at the end of class. This 3000-level course is focused on cultural competence in the helping professions and includes several course objectives related to social justice. In fact, social justice is one of the core values of the social work profession, and the National Association of Social Workers (2008) *Code of Ethics* mandates that social workers "pursue social change, particularly with and on behalf of vulnerable and oppressed individuals and groups of people" (sect. Ethical Principles, para. 3). In the class, Levy provided students with a handout including song lyrics, artist information, discussion questions, and contextual information about the time period in which the song was released (see Appendix 2). As the song played, she dimmed the lights and put up a picture of the band on the overhead screen. In this particular course, the songs were utilized to inspire students at the end of class and did not include discussion or critical analysis. However, she did attempt to select songs that related to the content that was covered during that week's class meeting(s). For example, during a discussion of gender equality in the workplace, she played Dolly Parton's 9 to 5. Unless students had heard about the music portion of class prior to the beginning of the semester, they often reacted with surprise and excitement upon learning about this aspect of the class. Students frequently made a point to say how much they enjoyed this part of class and how it was nice to be inspired by the music and take some time to contemplate the week's content. Midterm and final evaluations of this course always included positive comments about the use of music to teach social justice. Even though there was not always enough time to include discussion or analysis of lyrics, students were still inspired and moved by the music. When there was time to dialogue about the song's meaning related to social work, students were able to make connections to the profession's focus on challenging injustice. Further, students were enthusiastic about using music as a medium for support, empowerment, and comfort for their future clients.

In two social studies education courses for undergraduates in their teacher preparation programs, the second author, Byrd, followed a similar instructional approach as that which was described above. He selected music which addressed the main topics covered in each class session as a supplement to other activities. For example, as a means to consider current problems with war, racism, and political discourse, the video for Right Right Now Now by the Beastie Boys was shown at the end of a discussion around these same issues. This album was released during a particularly transformative and contentious period in U.S. history, a characteristic common in music focused on social justice. In this case, informational handouts were again distributed and students were asked to consider the ways they might use songs to address such topics in their own high school classrooms. An effort was made throughout the course to use a wide variety of artists from different genres. Course evaluations indicated a positive reaction to this aspect of the course. The student teachers who chose this instructional approach in their own classrooms reported that their high school students reacting with the same excitement and curiosity about the use of music to learn about social problems, historical decisions, and orientations to people and cultures around the world.

As part of an education and teaching course for high school students in a summer enrichment program, Byrd devoted one entire class meeting to using music as an entry point into social justice issues. Once again, students responded with enthusiasm and noticeably more interest in the ideas presented within each selection. Artists that were featured included the Black Eyed Peas, Cat Stevens, and the Beatles. When discussing the potential value of this instructional method, those who voiced their opinion agreed that music is a unique medium whose diversity of genres is both an affirmation of cultural responsiveness and a collection of various styles which inevitably appeal to many different listening preferences. This particular class consisted of students from different high schools, and interestingly, none reported having experienced music as an avenue to discuss social problems in any of their previous courses.

In addition to the examples listed above, instructors can have students write their own poem or lyrics based on what they have learned in class or even have students bring in their own music to share (Albers, & Bach, 2003; White, & McCormack, 2006). Students may also enjoy having a copy of all of the music played during the semester, though instructors will need to adhere to any applicable copyright laws. Finally, instructors may decide to post songs online and create listening logs and discussion forums for students in order to preserve class time for other topics.

IV. Conclusion.

In conclusion, many disciplines can utilize music as a teaching tool. The content is not limited to social justice and can be extended to subjects such as mathematics, history, religion, philosophy, psychology, science, and beyond. Instructors who wish to integrate music can do so in a variety of ways. First, songs can simply be an enjoyable supplement to reinforce course material. Alternatively, the context behind each song, the songwriter's personal connections, and the social problems addressed by the lyrics can be explored in greater detail. Lastly, music as a medium to transmit thoughts and ideas can also be compared with other forms of expression and information such as books, television, journal articles, and online resources. The possibilities are multiple and, as such, lend themselves well to instructors adapting music in whatever format they deem beneficial for their own students.

Additional research is needed in order to fully understand the impact of using music to teach social justice. Although this article does not intend to prioritize pedagogical decisions or teaching methods, understanding students' experiences with music would provide valuable information regarding the generalization of justice related content taught in this manner. It may be the case that other methods work equally as well and a combination of many techniques stands the greatest chance of connecting with students around issues of equality and human rights. Although additional research is needed, existing literature clearly demonstrates that music can be a powerful and creative way to examine content related to social justice. Our students have been pleasantly surprised by the use of music in our classrooms. We have found that it stimulates critical thinking and reflection, generates thoughtful discussions, and leaves lasting impressions.

Appendices

Appendix 1. Examples of Songs.

Artist	Song Title and Year	Main Topics (index below)
Ani Difranco	Crime For Crime (1995) Subdivision (2007) 'tis of Thee (1999) Willing To Fight (1997)	PA, P, R A, PA, P, R PA, P PA, A
Beastie Boys	In A World Gone Mad (2003) Right Right Now Now (2005)	PA, WP PA, R, WP
Ben Harper	Better Way (2006)	A, PA
Black Eyed Peas and Justin Timberlake	Where Is The Love (2003)	A, P, R, WP
Bob Dylan	Blowin' In The Wind (1963) The Lonesome Death Of Hattie Carroll (1964) The Times They Are A Changing (1964)	WP A, P, R PA
Bob Marley	Get Up Stand Up (1973) One Love / People Get Ready (1977)	PA A, PA
Charles Neblett	If You Miss Me At The Back Of The Bus (1963)	PA, P, R
Cat Stevens / Yusuf Islam	If You Want To Sing Out (1984) Peace Train (1976)	PA PA, WP
Christina Aguilera	Beautiful (2002)	A, S
Country Joe & The Fish	I Feel Like I'm Fixin' To Die Rag (1967)	PA, WP
Credence Clearwater Revival	Fortunate Son (1969)	P, WP
Dolly Parton	9 To 5 (1980)	PA, S, WR
Doobie Brothers	Takin' It To The Streets (1976)	A, PA, P
Elvis Presley	If I Can Dream (1968)	A, PA, WP
E. Y. "Yip" Harburg and Jay Gorney	Brother, Can You Spare A Dime? (1931)	PA, P
Garth Brooks	We Shall Be Free (1992)	A, PA, P, R
James Weldon Johnson and John Rosamond Johnson	Lift Every Voice And Sing (1905)	PA, R
Janet Jackson	Rhythm Nation (1984)	PA, P, R
John Lennon / The Beatles	All You Need Is Love (1967) I Don't Wanna Be A Soldier (1971) Imagine (1971) Give Peace A Chance (1969) Power To The People (1971) Revolution 1 (1968) So This Is Christmas (War Is Over) (1971)	A, PA WP A, PA, P, WP AC, WP PA, P, S, WR A, PA, WP A, PA, P, R, WP
Kanye West	Don't Look Down (2010)	PA, P
Living Colour	Open Letter (To A Landlord) (1988)	PA, P

Lupe Fiasco	Conflict Diamonds (2006)	PA, P, WP
Michael Jackson	Black Or White (1991) Man In The Mirror (1988)	PA, R, WP PA, P
No Doubt	Just A Girl (1995)	PA, S
Paul McCartney and Stevie Wonder	Ebony And Ivory (1982)	PA, R
Pete Seeger	We Shall Overcome (1947)	PA, R
Phil Collins	Another Day In Paradise (1989)	PA, P
Public Enemy	Fight The Power (1989)	PA, R
Ray Stevens	Everything Is Beautiful (1970)	A, PA, R
Robert Palmer	Every Kinda People (1978)	A, PA, P, R
Rod Stewart	The Killing Of Georgie (1976)	PA, H
Run DMC	Proud To Be Black (1986)	PA, R
Scorpions	Wind of Change (1990)	PA, WP
Stevie Wonder	Happy Birthday (1981)	A, PA, R
Sly And The Family Stone	Everyday People (1968) Thank You (1969)	A, PA A, PA
Sweet Honey In The Rock	Ella's Song (1983)	PA, S, R, WP
The New Seekers	I'd Like To Teach The World To Sing (1971)	A, PA, WP
The O'Jays	Love Train (1973)	PA, WP
The Original Caste	One Tin Soldier (1969)	PA, WP
WAR	Why Can't We Be Friends (1975)	A, P, R
Willie Nelson	A Peaceful Solution (2007) Cowboys Are Frequently Secretly (2006)	PA, WP PA, H
Woody Guthrie	This Land Is Your Land (1940)	PA, WP

Index of Topics Covered

A Acceptance of All People
H Homophobia
PA Political Activism
P Poverty
R Racism
S Sexism
WP War and Peace
WR Workers' Rights

Appendix 2. Example of Handout.

Imagine

In June of 1971, John Lennon recorded the song *Imagine* in just three takes (Fricke, 2002). A ballad for human rights, advocacy, and peace, *Imagine* continues to be relevant nearly 40 years later. Just a few years after the assassinations of Martin Luther King Jr. and Robert F. Kennedy, 1971 also included numerous historical events. China joined the United Nations, the Nasdaq stock index was born, the voting age was changed from 21 to 18, Walt Disney World opened, 60% of Americans were against the Vietnam War, Greenpeace was created, Charles Manson and three of his accomplices were found guilty and sentenced to death, Jim Morrison was found dead, Texas Instruments marketed its first pocket calculator, and popular musicians included the Doors, James Taylor, Michael Jackson, the Rolling Stones, the Who, and Janis Joplin (The People History, 2009).

Imagine there's no heaven
It's easy if you try
No hell below us
Above us only sky
Imagine all the people
Living for today...
Imagine there's no countries
It isn't hard to do
Nothing to kill or die for
And no religion too
Imagine all the people
Living life in peace...
You may say I'm a dreamer
But I'm not the only one
I hope someday you'll join us
And the world will be as one
Imagine no possessions
I wonder if you can
No need for greed or hunger
A brotherhood of man
Imagine all the people
Sharing all the world...
You may say I'm a dreamer
But I'm not the only one
I hope someday you'll join us
And the world will live as one

Discussion Questions

1. How does knowing about the context in which the song was written influence your thoughts about the song's meaning?
2. In thinking about specific lyrics of this song, what would society be like if these imagined goals were realized?
3. Is this song still relevant for today's society? What are some additional lyrics or topics that could be added?
4. Is the song encouraging us to simply imagine a better world or to actually do something to make the world a better place?
5. What can we do in order to work toward the goals mentioned in the song?

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Improving student engagement in a lower-division botany course

Nisse A. Goldberg[1] and Kathleen W. Ingram[1]

Abstract: Active-learning techniques have been advocated as a means to promote student engagement in lower-division biology courses. In this case study, mini-lectures in combination with active-learning activities were evaluated as strategies to promote a culture of learning and participation in a required botany course. These activities were designed to develop critical-thinking skills, i.e. Bloom's synthesis, application, and analysis. Student attitudes toward learning, participation, and class activities were assessed with feedback surveys following each activity, at the beginning with a pre-survey and at the end of the semester with a retrospective survey. Students identified concept maps, problem-solving exercises, and the categorizing grid as helpful to their learning. Based on instructor observations, students were especially engaged in activities that allowed them to demonstrate creativity and resourcefulness. Based on the retrospective survey results, students were more conservative in their perception of personal critical-thinking skills at the end of the semester, which may be a reaction to the challenges in developing critical-thinking skills. The incorporation of mini-lectures with class activities helped to promote student engagement in the classroom and thus, was a positive instructional strategy.

Keywords: biology, participation, undergraduate

I. Introduction.

Introductory biology classes are traditionally delivered two to three times per week, with one three-hour lab section. In general, professors lecture throughout the class period with periodic questioning of students that addresses lower level-order cognitive (LOC) thinking skills. This teaching style can result in nominal student-student and student-professor interactions (Crowe, Dirks, & Wenderoth, 2008). By comparison, the lab sessions are designed to offer the opportunity for active learning that engages the student and develops higher-order cognitive (HOC) skills, e.g. synthesis and analysis (Crowe, Dirks, & Wenderoth, 2008), through active participation and problem-solving.

As an instructional strategy, class group activities aim to promote active engagement during the lecture period. Active engagement is linked to increased motivation to learn, which can translate into a greater likelihood of meeting learning outcomes (Driscoll, 2000). According to Keller's Attention-Relevance-Confidence-Satisfaction (ARCS) Motivational Model, students motivation can be stimulated by including strategies that capture their Attention, provide Relevance of the course material to their needs and goals, stimulate Confidence in succeeding in the course, and provide Satisfaction in their performance (Keller, 1984).

In addition, active-learning class activities provide opportunities for students to develop the critical thinking and problem solving skills necessary to meet HOC learning outcomes (Allen, & Tanner, 2005; Smith, Stewart, Shields, Hayes-Klosteridis, Robinson, & Yuan, 2005).

[1] Jacksonville University, 2800 University Blvd. North, Jacksonville, FL, USA. 32211

To this end, professors should support students' use of deep rather than surface approaches to learning (Hall, Ramsay, and Raven, 2004; Gabriel, 2008; Nelson Laird, Shoup, Kuh, & Schwarz, 2008).

Based on Bloom's Taxonomy, surface learning requires LOC skills such as memory recall and the ability to identify or describe subject material (Crowe, Dirks, & Wenderoth, 2008). By comparison, development of HOC skills promotes greater understanding and extended knowledge retention (Gabriel, 2008). Walker, Cotner, Baepler, and Decker (2008) suggest that combining active-learning activities with mini-lectures increases student engagement, and subsequently student command of the learning outcomes.

Botany is a required course for all biology and marine science majors at our traditional, liberal arts university and is often met with a degree of resistance. Because of the first author's previous experience with student attitudes in the lower-division botany course, she introduced an instructional strategy of mini-lectures combined with active-learning class activities. The authors aimed to investigate whether such a strategy would promote student engagement and positive attitudes towards learning. Activities (concept maps, problem-solving activities, and categorizing grids) were designed to provide relevance of course material, and to develop engaged learning, attention, and HOC skills. These activities were aligned with course objectives and were implemented throughout the fall 2009 semester.

II. Methods.

Because the purpose of this study was to explore the use of instructional strategies in a specific course, the authors employed a mixed methods (Johnson, & Christensen, 2004) research design that focused on a single case. Yin (1994) defines a case study as "… an empirical inquiry that investigates a contemporary phenomenon within its real-life context…" (p. 13), the purpose of which is to "…maximize what we can learn" (Stake, 1995, p. 4). This type of research also has roots in the literature of classroom research and the Scholarship of Teaching and Learning (SoTL) in higher education (Boyer, 1990; Cross, & Steadman, 1996; McKinney, 2007; Weimer, 2006).

In this mixed-methods study, the case study was a lower-division botany course with an enrollment of 36 students. Based on a personal-information questionnaire, 32 of the 36 students identified themselves as biology majors with a pre-professional (medicine, pharmacology, and veterinarian sciences) emphasis or as a marine science major. The remaining students identified themselves as biology majors with interests in the natural sciences. This single case was used to explore the effectiveness of an instructional strategy that combines mini-lectures with class activities in an effort to promote student engagement and develop HOC skills. Interpretations from the case study were drawn from various sources (Merriam, 1998) that included student pre- and post-surveys, feedback surveys, personal observations, test scores, and attendance records.

To explore the possible impacts of class activities on student learning, we compared mean exam scores between the fall 2009 course to scores from a similarly-sized class that was taught by the same professor in spring 2009, without class activities. The scores were used solely for a qualitative comparison because we could not treat the spring course as a control. Our study had received ethics approval from the university's Institutional Review Board.

A. Instruments.

Student motivation for learning is multidimensional and therefore hard to measure accurately with only Likert-style instruments. Fulmer and Frijters (2009) suggest that more authentic measures of motivation might be "…participant observation, case studies, and semi-structured, retrospective surveys…" (p. 231). Our case study used semi-structured self-report surveys to collect both quantitative and qualitative data related to individual experiences (e.g. motivation) for each instructional strategy.

The self-report surveys included a pre-survey given at the beginning of the semester, a retrospective survey given at the end of the semester, and a survey following each class activity. All surveys were anonymous and voluntary and had received ethics approval by the Instructional Review Board prior to the study. The surveys assessed students' general attitudes toward the learning process, group participation, and personal critical-thinking skills (see Appendix 1) and were administered during the first day of class and at the end of the semester. To better understand students' perceptions of prior knowledge, the pre-surveys also included questions regarding their familiarity with photosynthesis, stages of meiosis/mitosis, plant life cycles, plant diversity, and plant cellular biology.

After each activity, students' attitudes toward class activities were measured according to their self-reported perceptions regarding three of the four components of Keller's (1984) motivational model: relevance, confidence, and satisfaction. To measure perceived relevance and confidence, the surveys asked the students to rank their ability to apply material learned from the text ('I felt that I could apply what I learned from the text for this activity') and lecture ('I felt that I could apply what I learned from the lecture for this activity'). To further measure confidence in their grasp of the material, students were asked 'After doing the activity, I felt more confident about knowing the material'. To measure satisfaction, the surveys asked the students to rank the question 'I found the activity useful for my learning of this material'. The surveys also gave students the opportunity to provide narrative feedback regarding the value of and suggestions to improve each activity. To increase satisfaction, the instructor sent emails summarizing the students' responses and identified adjustments to future activities. In addition, the students were asked to rate their level of participation ('I participated in the group activity').

B. Activities.

To ensure that students had read assigned material in the textbook prior to lecture, completion of online quizzes was required on a weekly basis. These quizzes targeted the LOC skill of recall of terminology and processes. Detailed lecture notes were made available online via the university's course management tool, and were used to supplement lectures given during class. Video clips downloaded from the Internet were used to further illustrate material presented during each lecture.

A combination of active-learning activities with mini-lectures was used as an instructional strategy to promote engagement and command of learning outcomes (Walker, Cotner, Baepler, & Decker, 2008). The activities were multi-faceted, drew upon previous knowledge, and allowed for confidence building. Keller's (1984) ARCS Motivation Model identified such attributes as essential to student learning (Driscoll, 2000).

Mini-lectures were used to deliver content and aimed to circumvent resistance from students unused to directing and applying their own learning (Allen, & Tanner, 2005). The

activities were varied to meet the session learning outcomes and to increase interest for learning (see Table 1). Specifically, concept maps, problem-solving activities, categorizing grids, and approximate activities were designed to target HOC skills of synthesis, analysis and application (see Table 1, Angelo, & Cross, 1993; Crowe, Dirks, & Wenderoth, 2008).

We used a course design that alternated between 1) sessions dedicated entirely to lectures with five-minute breaks during the 75-minute class period and 2) sessions that incorporated active-learning activities. On days that included a class activity, the instructional design followed a prescribed order: mini-lecture, activity, debriefing of activity with feedback, and the completion of feedback survey. The relevance of each activity was explained in the syllabus and in the introduction of each activity. In an effort to promote student confidence, immediate feedback was provided to individuals during each activity and with guided class discussions following each activity.

Student satisfaction was assessed with feedback surveys immediately after each activity and then reported back to the students with a summary of their comments by email. In addition, detailed feedback was provided throughout the class period, as suggested by Walker, Cotner, Baepler, and Decker (2009), Reddy (2000), and Chickering and Gamson (1987). The constant feedback allowed students to demonstrate learning outcomes and to address any gaps in their knowledge, and thus helped to build student confidence (Chickering, & Gamson, 1987; Keller, 1987).

C. Analyses.

One-way analysis of variance was used to test for differences among the six activities (N = 25 respondents) and between responses from surveys given at the beginning and end of the semester (see Appendix 1). In an effort to keep an equal sample size for univariate statistical tests, the lowest sample size from one collection of feedback surveys was used, although numbers ranged between 25 and 34 respondents per activity. Responses from the pre-survey were not significantly different from the retrospective pre-responses, $p > 0.05$. For this reason, a paired t-test was used to test for differences between the retrospective survey responses (designated with a 'Retro-pre' and 'Retro-post' in Appendix 1). Assumptions of normality and equal variances were assured before conducting each test.

We used exam scores from two botany courses to explore whether the inclusion of class activities may have contributed to student performance. Mean exam scores from the fall 2009 course were compared to scores from a similarly-sized class that was taught by the same professor in spring 2009, without class activities. Exam questions from both classes included short answers that targeted skills in synthesis, analysis and application of course material.

III. Results.

A. Initial and retrospective surveys.

At the beginning of the semester, students were asked to rate their critical-thinking skills and attitudes towards learning. Student perception of their critical-thinking and communication skills and attitudes toward learning were more positive (1 = strongly disagree, 3 = agree, and 5 = strongly agree) than their perception of group activities. Mean responses (± 1SE) to the statements "I feel that I have good critical-thinking skills" and "I feel that I have excellent

Table 1. Description of in-class activities that target critical-thinking skills, based on Angelo and Cross (1993).

Specific skill	Topic	Instructional strategy/activity
[1]Synthesis, [3]Application	Nutrient uptake pathway of a nutrient, molecules that utilize the nutrient, and functions of those molecules in a plant cell	*Concept maps to assess connections.* Given illustrations of a plant and plant cell, students were asked to identify uptake pathway and organelles that utilize molecules composed of given nutrient. Functions of each molecule were described alongside each organelle. In addition, students were asked to link the different levels (plant, leaf, and cell) to show connections from the macroscopic to intracellular scales.
[1]Synthesis [2]Analysis	Evolution of traits for photosynthetic organisms	*Concept maps to assess connections.* Students were asked to draw a circle around each photosynthetic group and a line between groups that are evolutionarily most similar. Next to each line, students wrote down traits shared between the two groups. This activity required students to identify features that show similarities among groups (life cycles, chlorophyll *a*) and also how they diverged (vascular tissue, accessory pigments, seeds, flowers).
[1]Synthesis, [3]Application	Respiration and fermentation processes	*Problem solving.* Students were asked to debate whether growing corn for fuel or food is more efficient, based on energy required for respiration and fermentation
[1]Synthesis, [3]Application	C3, C4, and CAM pathways	*Problem solving, concept maps.* Students were asked to trace the pathway of inorganic carbon/water uptake at the organismal level to synthesis of sugar at the cellular level for C3, C4, and CAM plants. Students were given the sugar (cane sugar, maple syrup, and cactus juice) as a starting point.
[2]Analysis	Movement of molecules via osmosis, passive/facilitated diffusion, and vesicle-mediated transport	*Categorizing grid.* Students were asked to fill in a table during lecture that compared ways in which compounds and large molecules enter/exit plant cells.
[1]Synthesis, [3]Application	Life cycles of algae and fungi	*Approximate analogies*. Students were asked to create an illustrated children's story based on either an alga or fungus life cycle that includes when fertilization and meiosis occurs, haploid and diploid generations and what each generation produces (gametes or spores).

Note: [1]Synthesis: reorganizing information; [2]Analysis: taking apart information; and [3]Application: using knowledge to solve problems (Angelo and Cross, 1993)

communication skills" were 2.7 (± 0.2) and 2.5 (± 0.2). Mean responses to the statements "I enjoy the process of learning" and "I think that I will enjoy learning about botany this semester"

were 2.9 (± 0.2) and 2.8 (± 0.2), respectively. Students were less positive towards group participation. In response to "I feel that group activities help me to learn course material", "I actively participate in group activities to improve learning", and "I feel that I learn material better by participating in critical-thinking group activities" were 2.6 (± 0.3) and 2.6 (± 0.2), and 2.7 (± 0.25), respectively.

Students were asked about their familiarity with specific biological concepts. Of the 33 respondents, all were familiar with photosynthesis, 97% were familiar with mitosis/meiosis, 67%, and 70% of the students were familiar with plant life cycles and plant diversity. Only 52% were familiar with plant cellular biology.

To investigate changes in student perception after a semester of participation in the class activities, students were asked to rate their critical-thinking skills and attitudes towards learning using a retrospective survey. Students were significantly more conservative in their assessments of their critical-thinking skills at the end of the semester (paired t-test$_{27}$ = 2.88, p = 0.008; see Figure 1). In addition, they were significantly less positive towards the process of learning by the end of the semester (paired t-test$_{27}$ = -2.87, p = 0.008, see Figure 1). Students showed no significant changes in attitudes towards their participation in group activities and activities that targeted critical-thinking skills ($p > 0.090$; see Figure 1).

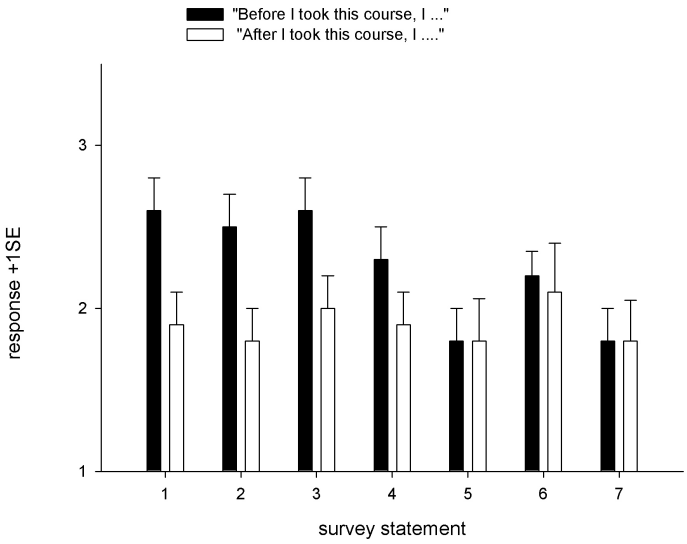

Figure 1. **Mean student responses (+ 1SE) to the retrospective survey given at the end of the semester.** Survey responses: 1 = strongly disagree, 3 = agree, and 5 = strongly agree. Retrospective pre-statements began with "Before I took this course, I ,…". Retrospective post-statements began with 'After I took this course, I….'. Retrospective pre- vs post- survey statements: 1) I felt that I had good critical-thinking skills vs. I felt that I increased my critical-thinking skills; 2) I enjoyed the process of learning vs. I feel that I have a greater interest in the process of learning; 3) I thought that I would enjoy learning about botany vs. I felt that I enjoyed learning about botany; 4) I felt that I had excellent communication skills vs. I feel that I have stronger and more effective communication skills; 5) I felt that group activities help me to learn course material vs. I found that group activities help me learn course material; 6) I would actively participate in group activities to improve my learning vs. I feel that I am more willing to actively participate in group activities to improve my learning; and 7) I felt that I learned

material better by participating in critical-thinking group activities vs. I feel that I learn material better by participating in critical-thinking group activities. N = 25 students.

B. Activities surveys.

In general students did not identify any activity as being especially helpful or ineffective to their learning (see Figure 2). Post-activities responses were not significantly different ($p > 0.46$, N = 25 students) among the six activities with application of their knowledge from the text and lecture, usefulness of the activity to their learning, and participation in the activity. A significant difference was identified ($F_{5, 144} = 2.79$, $p = 0.019$, see Figure 2) with respect to confidence in the material. Tukey's pairwise comparisons indicated that students felt more confident following the debate (2.8 ± 0.2) as compared to the nutrient-uptake activity (1.7 ± 0.2; $p = 0.014$; see Figure 2).

In order to evaluate students' abilities to apply course material, we compared first and final mean exam scores between the fall 2009 course to scores from a similarly-sized class that was taught in spring 2009, without class activities. Mean exam scores suggested that students in the fall course were better able to apply course content by the end of the semester (see Table 2). Exam scores increased over the fall semester, with mean (± 1SE) exam scores of 77% (± 2.9) for the first exam and 85% (± 2.6) for the fourth exam. By comparison, the spring semester scores were 78% (± 3.7) for the first exam and 61% (± 4.7) for the fourth exam (see Table 2). Mean daily attendance (80%) was the same for both semesters.

Table 2. Student mean exam scores (% ± 1 SE) from fall 2009 (class of 36 students) and spring 2009 (class of 34 students) botany courses (N = 4 exams). Fall 2009 included class activities.

Exams	Spring 2009 No class activities	Fall 2009 With class activities
First	77.6 ± 3.7	77.2 ± 2.9
Second	78.0 ± 4.3	69.7 ± 3.0
Third	73.6 ± 4.2	85.5 ± 2.7
Final	60.7 ± 4.7	84.6 ± 2.6

The narrative feedback from each survey provided information regarding student feelings immediately following each activity. In general, students appreciated the group activities and were cognizant of how the activities were tied to course material. Students remained on-task during the activities, talking among themselves and utilizing their text, phones, and computer as research tools. With respect to the ethanol debate, students described the discussion as "spirited", "intense", and "active", and appreciated learning how the material (respiration and fermentation) "applied to the real world". For many, the topic was an "eye opener". The atmosphere during the research period prior to the debate ranged from one of intense concentration to light-hearted exchange.

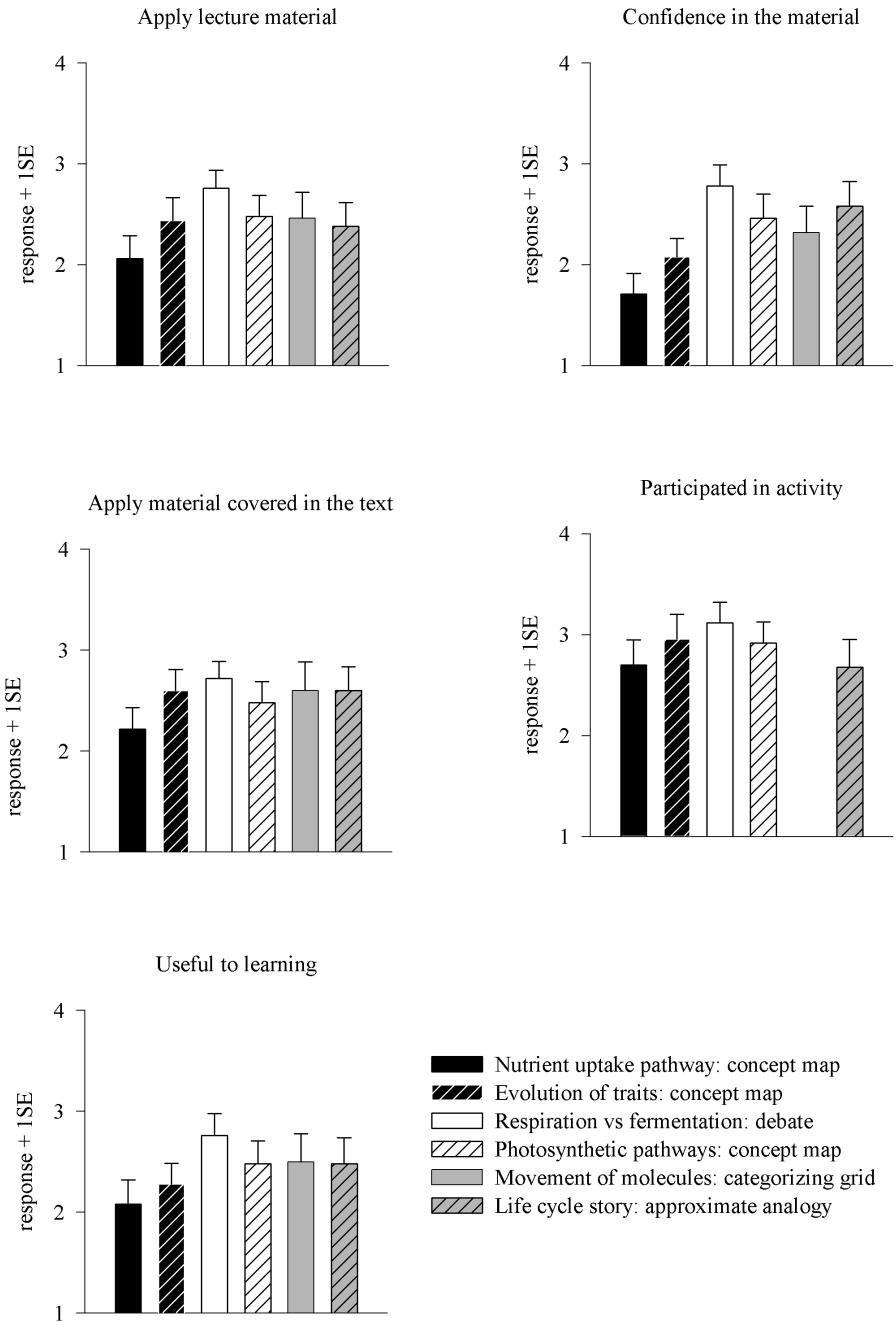

Figure 2. Mean responses (+ 1SE) of students to survey statements that assessed their ability to apply material from the lecture and text to the activity, usefulness of the activity to their learning, confidence in the material following the activity, and participation during the activity. 5 = strongly agree, 3 = agree, and 1 = strongly disagree. N = 25 students. Table 1 provides a description of each activity. Participation was not surveyed for the 'Movement of molecules' activity.

Students were introduced to different ways to study the material. In particular, they learned how to organize their notes (categorizing grid) while listening to lectures and to synthesize the material (concept maps). During the feedback period following the activity, students admitted that the concept map was new learning tool. From the written surveys, students wrote that they appreciated "seeing the information visually", that the maps "showed links, organized traits", and "related everything together". Many enjoyed the activities that allowed them to draw with crayons and sidewalk chalk (photosynthesis diagram and life cycle activities). One student volunteered that "drawing made me want to participate" and others identified how the activity "showed connections of photosynthesis". In response to the photosynthesis activity, another student had written that, in participating, they were able to "focus on the details, actually learn, and it helped a lot to understand it better". When commenting on the life-cycle activity (see Table 1), one student admitted that they were "skeptical at first- that it was different, but that I (*the student*) understood what I (*the student*) was teaching (*to the rest of the class*)". As a whole, the students enjoyed that the activity was outside and challenged them to think creatively.

At the end of the semester, the student attitudes were generally positive about the course's goals in promoting learning with activities that targeted HOC skills. Based on narrative responses, one student reflected that this course "made me want to focus and go more in depth with my studies" and introduced me to "new ways of studying". Another student wrote that botany was "far more interesting and fun than I thought". Many students appreciated the group interactions with similar comments that 'group activities make clear what my weaknesses are and allow me to gain an understanding of the material' and an opportunity to "learn from other people". One student noted that the class activities "facilitate greater exposure to material and different ways of applications".

Based on the narrative feedback, students recommended changes primarily related to classroom and time management and highlighted the need for further clarification of some activities. Students requested more time to work on the activities, to do more research for the debate, and to cover more life cycles. They asked to have time at the end of each session to review the activities as a class, to be able to pick group partners, and to have smaller groups. Students mentioned that lecture-hall setting with fixed seats made it challenging to work in groups. Although some students did appreciate the categorizing grid, a number of students found the note-taking activity confusing. The concept map was considered the most confusing to those who preferred "a structured shell" that was provided by the instructor.

IV. Discussion.

Active-learning activities with mini-lecture helped to promote student engagement and achievement of HOC learning outcomes in a lower-division botany course. Student motivation was sustained throughout the semester, as indicated by an 80% average attendance, and a mean of greater than 70% on exam scores. Student-professor and student-student interactions, diversity in instructional strategies, and relevance of the activities to learning outcomes likely contributed to student interest in participation (Chickering, & Gamson, 1987; Keller, 1987). Despite gains in engagement, students were more conservative in their critical-thinking (HOC) abilities following a semester of class activities, indicating the complexities inherent in student motivation.

Students reacted most positively to activities that required research and creativity. For example, the ethanol debate (problem solving), life cycle (approximate analogy) and photosynthesis (concept map) activities were given strong scores following the activities. The

ethanol debate addressed a topical and controversial subject that may have encouraged friendly competition among students, which can stimulate motivation (Keller, 1987). The life cycle and photosynthesis activities allowed students to demonstrate their understanding in a visual context that may not be otherwise possible in a typical lecture format. Students indicated in their comments the value in "seeing the information" that "showed links" and "connections". We suggest that in addition to providing relevance, student creativity is a factor to be considered when designing class activities.

Our instructional strategy of utilizing active-learning techniques may have contributed to academic performance in addition to promoting student engagement. We observed gains in mean exam scores over the course of the semester (gain of +7% between first and last exam with a final exam score of 84%) as compared to a botany course taught without class activities the previous semester (loss of -17% between first and last exam with a final exam score of 61%). Similarly, Reddy (2000) reported mean final exams of 90% in a pharmaceutical class utilizing active-learning techniques as compared to 80.5% in a similar class taught traditionally with lectures. Walker, Cotner, Baepler, and Decker (2008) reported a mean final percentage score of 75% and 71.5% in an introductory biology course with (n = 263 students) and without (n = 240) active-learning techniques, respectively.

Despite evidence in student engagement during class activities, students did not report significant gains in confidence with respect to their critical-thinking skills at the end of the semester. Interestingly, Walker, Cotner, Baepler, and Decker (2008) also reported a drop in student confidence towards 'science-related skills and knowledge' following a semester of active-learning activities. Perhaps the challenging nature of the activities contributed to a more conservative perception of their personal critical-thinking skills and of the learning process. In addition, the lack of a neutral value on our ranking scale may have confused the students.

Another explanation for the lack of significant change between students' pre- and post-self-reports of change in content-specific and critical-thinking abilities could be related to response shift bias (Drennan, & Hyde, 2010) and therefore a move from a naive to more expert mental model (DeBacker, Crowson, Beesley, Thoma, & Hestevold, 2008). Response shift bias is the reconceptualization of a construct due to an intervention (e.g. instruction) that results in students "… rating their ability on a different dimension or metric at time two (post-test) due to the development of a greater understanding of the construct under investigation" (Sprangers, 1988 as reported in Drennan, & Hyde, 2010, p. 700). While we did employ a retrospective survey design to try to control for this type of bias, we did not specifically match pre-survey given at the beginning of the semester and the retrospective survey by respondent.

We argue that the instructional strategy of mini-lectures combined with activities targeting higher-order cognitive (HOC) skills succeeded in promoting a culture of student engagement in a course that had been met previously with student reluctance. Based on this case study we advocate an instructional strategy that includes mini-lectures with active-learning activities designed to promote learning outcomes and interactions with the students (Chickering, & Gamson, 1987; Reddy, 2000). At the end of the semester, many students described the course as interesting and appreciated being exposed to new ways of learning. Engagement, participation, and positive attitudes were apparent with the balance between class activities and lectures despite the limitations of a lecture-hall setting. In the future, we would ask students to write a reflection essay at the end of the semester that addresses their confidence towards learning and their critical-thinking skills, to better understand changes in perception from the beginning and end of the semester. In an effort to better address the multidimensional nature of

student motivation, future research studies will be designed to look at more authentic ways of measuring motivation.

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Appendix 1. Seven survey statements given to the students at the beginning of the semester with a pre-survey (designated with Pre.) and end of the semester with a retrospective survey (designated with Retro-pre. and Retro-post.)

#	Survey statement	Strongly Disagree		Agree		Strongly Agree
	Pre. I feel that I have good critical thinking skills (ability to solve problems based on material presented in the class).	1	2	3	4	5
1	**Retro-pre.** Before I took this course, I felt that I had good critical-thinking skills (ability to solve problems based on material presented in the class).	1	2	3	4	5
	Retro-post. After I took this course, I felt that I increased my critical-thinking skills.	1	2	3	4	5
	Pre. I enjoy the process of learning.	1	2	3	4	5
2	**Retro-pre.** Before I took this course, I enjoyed the process of learning.	1	2	3	4	5
	Retro-post. After I took this course, I feel that I have a greater interest in the process of learning.	1	2	3	4	5
	Please add comments to your response:					
	Pre. I think that I will enjoy learning about botany.	1	2	3	4	5
3	**Retro-pre.** Before I took this course, I thought that I would enjoy learning about botany.	1	2	3	4	5
	Retro-post. After I took this course, I felt that I enjoyed learning about botany.	1	2	3	4	5
	Please add comments to your response:					
	Pre. I feel that I have excellent communication skills (writing, listening, speaking, reading, interacting).	1	2	3	4	5
4	**Retro-pre.** Before I took this course, I felt that I had excellent communication skills (writing, listening, speaking, reading, interacting).	1	2	3	4	5
	Retro-post. After I took this course, I feel that I have stronger and more effective communication skills (writing, listening, speaking, reading, interacting).	1	2	3	4	5
	Please add comments to your response:					

	Pre. I feel that group activities help me learn course material.	1	2	3	4	5
5	**Retro-pre.** Before I took this course, I felt that group activities help me learn course material.	1	2	3	4	5
	Retro-post. After I took this course, I found that group activities help me learn course material.	1	2	3	4	5
	Please add comments to your response:					
	Pre. I actively participate in group activities to improve my learning (share ideas, listen to others, incorporate ideas of others).	1	2	3	4	5
6	**Retro-pre.** Before I took this course, I would actively participate in group activities to improve my learning (share ideas, listen to others, incorporate ideas of others).	1	2	3	4	5
	Retro-post. After I took this course, I feel that I am more willing to actively participate in group activities to improve my learning.	1	2	3	4	5
	Please add comments to your response:					
	Pre. I feel that I learn material better by participating in critical-thinking group activities.	1	2	3	4	5
7	**Retro-pre.** Before I took this course, I felt that I learned material better by participating in this critical-thinking group activities.	1	2	3	4	5
	Retro-post. After I took course, I feel that I learn material better by participating in critical-thinking group activities.	1	2	3	4	5
	Please comment to your response:					

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Using word clouds to develop proactive learners

Frances Miley[1] and Andrew Read[2]

Abstract: This article examines student responses to a technique for summarizing electronically available information based on word frequency. Students used this technique to create word clouds, using those word clouds to enhance personal and small group study. This is a qualitative study. Small focus groups were used to obtain student feedback. Feedback indicated that students adapted their use of word clouds in ways consistent with their learning style preferences. Kolb's learning styles inventory was used. Student response also indicated that word clouds have potential in the workplace.

Key words: accounting education, deep learning, graduate attributes, Kolb's learning styles inventory, motivation, workplace learning, word clouds.

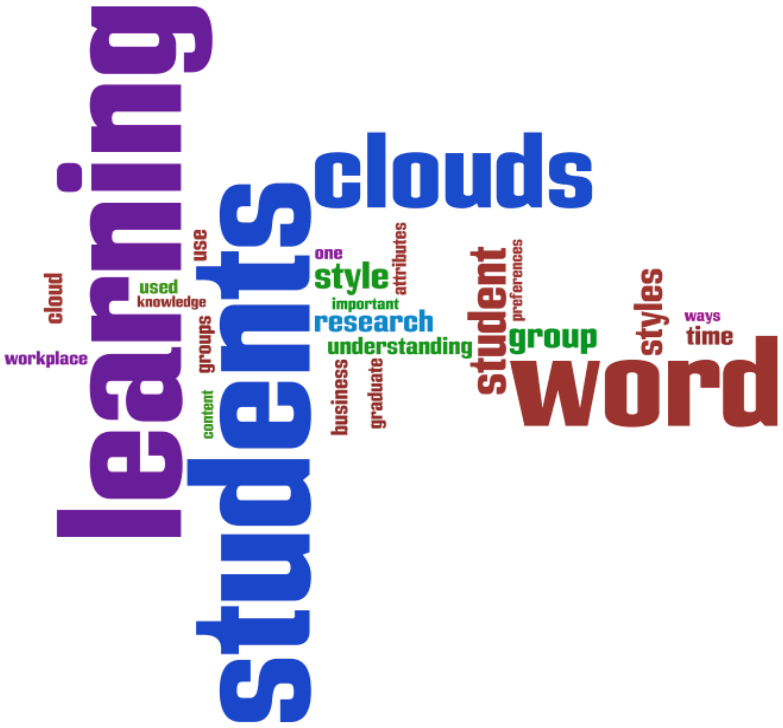

Figure 1. Wordle word cloud of this article.

> Give a man a fish and he will eat for a day. Teach him how to fish and he will eat for a lifetime (Chinese Proverb).

In 2009, an informal survey of 69 final year undergraduate students studying accounting as part of a Bachelor of Business degree program indicated that their main concern was that employers expected them to remain current with business developments but many confessed they were overwhelmed by the amount of information this involved and at the rate of entry of new information. In particular, they were concerned about how to remain familiar with the breadth of information and summarize it to ensure depth of understanding. The students

[1] University of New South Wales at the Australian Defence Force Academy
[2] University of Canberra

expressed a lack of confidence with managing knowledge acquisition in a workplace, stating that they did not think their present studies fully equipped them for this task. To assist them in developing this skill, the students were introduced to word clouds. Word clouds provided a tool to assist current learning and with summarizing workplace information. The potential of word clouds to assist with the conflict between the plethora of internet material versus our limited reading time has been recognized (Godwin-Jones, 2006). The success of using word clouds as a learning tool with potential to assist with workplace information management is described in this article.

I. Word Clouds.

Word clouds developed from web based social networking sites, which are web sites that allow a group of common users to share information. Social networking sites may be closed, such as the ones that operate within specific organisations, or open sites freely available to any Internet user. Popular open use sites include MySpace, FriendWise, FriendFinder, Yahoo! 360, Facebook, Orkut, and Classmates. The concept of word clouds developed from the tags or descriptors used to identify photographs posted to social networking sites such as Flickr, a site specifically designed for multiple sharing of photographs. The concept quickly extended to other websites that allowed users to tag their favourite books or identify their favourite web sites. Other users could search for these tags as an indicator of popularity, although they could not know about the bias or reliability of the tags. Word clouds have been viewed as a useful adjunct to teaching reading and writing skills (Hayes, 2008) and for summarizing research interviews (McNaught & Lam, 2010) but there is a dearth of research into their use to enhance student learning.

Word clouds, also called tag clouds or a weighted list, are a visual depiction of the frequency tabulation of the words in any selected written material, such as lecture notes, a textbook chapter or an internet site. Font size is used to indicate frequency, so the larger the font size, the more frequently a word is used. A word cloud abstract from the content of this article is provided above as an illustration. To create this abstract, an internet program freely available at www.wordle.net was used. Wordle allowed us to set features such as the number of words included, font, layout and color. We could delete common words such as conjunctions and prepositions but could neither insert nor delete nouns, verbs, adjectives or adverbs. The word cloud abstract represents the words used most frequently in this article within the parameters we could set. Wordle was the program used by the students referred to in this article. The advantage of word clouds is that they create a simple visual image. They emphasize the most frequently used words, allowing students to focus on them and reflect upon whether they would have emphasized the same words. Word clouds can act as a memory jogger about previously read material or a summary of written material, providing a useful aid when students are revising for examinations. Disadvantages of word clouds are that because they prioritize words by frequency of use, key concepts may be excluded because the words used to describe a concept appear infrequently, terms comprising more than one word, such as “word clouds” are treated as two separate words, and the word cloud created in Wordle can only be altered within pre-set parameters. The primary purpose of this research is to introduce word clouds as a learning tool adaptable to any discipline area.

The secondary purpose is to explain how the accounting students proactively adapted the way they used word clouds. This illustrates the flexibility of the technique. However, students tended word clouds only in ways consistent with their learning style preferences, which may have limited their value as a tool for individual learning because it suggests that they were only open to learning techniques in their comfort zone rather than those which were challenging to them. The strong tendency for the accounting students to use word

clouds only in ways consistent with their learning styles may have been an anomaly or coincidence; the relatively small size of the group (69 students) and short time frame involved in this research (two semesters of 13 teaching weeks per semester) increases the likelihood of mistaking coincidence for a significant outcome. In view of the lack of substantial prior research into the use of word clouds as a learning tool, it is not possible to know how generalizable the results of this research may be but it is possible to state that the tendency of students to use word clouds in ways consistent with their learning style preferences was so marked that further research is desirable into how students use word clouds, or more broadly, whether students constrain their use of learning tools to those consistent with or adaptable to individual learning style preferences and any implications for teaching and learning.

Students were shown how to create word clouds using material from lecture PowerPoints and internet sites. They were warned about the limitations of word clouds and to use them as an adjunct to rather than substitute for other learning techniques. In proactively exploring additional ways to use word clouds beyond those demonstrated in class, the students were taking ownership of and modify their learning processes to suit their individual needs consistent with a responsible approach to learning (White, 1988). Learning is more effective if students can take ownership of the method of learning and not only the content of that learning (Enghag & Niedderer, 2008).

After describing word clouds, the literature that underpins this research is canvased then student responses to using word clouds are explored. This article examines the content of focus group responses relating to the use of word clouds, how students adapted word clouds in ways consistent with their learning style preferences and the value students saw in using word clouds in a workplace. It provides an insight into how students used a learning innovation they viewed as having current and ongoing relevance.

Students were fully apprised of the limitations of word clouds. Although introduced as an optional learning aid to be used judiciously with other learning techniques, all students enthusiastically adopted word clouds to create summaries of lecture notes and Powerpoints for revision purposes. However, most went much further in their use of word clouds. When asked about this in voluntary focus groups, a distinct pattern emerged of students using word clouds in ways consistent with their learning styles preferences. In another context, students had previously undertaken self-assessment of their preferred learning style. Our concern was that this predisposed them to view their use of words clouds as consistent with what they knew about their learning style preferences. However, the students failed to detect that they were using word clouds in ways consistent with their preferences; it was academic staff who detected the correlation. Students seemed unaware of any link between how they used word clouds and their learning style preferences. In their view, to quote one student, “it just seemed the obvious thing for me to do”.

Focus group discussions also revealed that students thought the ability to create and use word clouds was an important graduate attribute for business students. Since they were all business students, their discipline based qualification reflects their proclivities.

II. Method.

The enthusiastic student take-up of word clouds was initially discovered from their informal comments during classes. This prompted independently mediated voluntary focus groups in which all students chose to participate. Focus groups of approximately 12 students per group facilitated by academic staff were used to seek feedback responses. In view of the lack of prior research into the use of word clouds to enhance student learning, it was considered important to obtain the richer data of a free flowing focus group discussion with minimal

intrusion from the facilitator. Responses were recorded *verbatim* and later transcribed. Although students were commenting on their experiences with using word clouds over two semester long periods, they had been using the language of learning styles for almost three years. The student demographic was that all but two students were of Australian ethnicity, with only four mature age students and a gender skew of 56 male and 13 female students. The non-Australian students were from New Zealand and Singapore. All students were enrolled in a Bachelor of Business degree program.

An important feature of the teaching strategy was a constructivist student-led approach to learning in which students worked in small self-selected groups to facilitate peer learning. Research indicates that working collaboratively is critical in many business environments (Angehrn & Maxwell, 2009; Ofstedal & Dahlberg, 2009) and identifies benefits in peer learning (Evans & Cuffe, 2009; Miley, 2004). Focus groups had the advantage that students could listen to the experiences of their peers and use them for comparative reflection against their own experiences. This was considered consistent with the constructivist philosophy, so that the opportunity to reflect on word cloud usage became part of student learning while also providing insight for academic teaching staff and for research purposes. Focus groups were also thought to provide richer data about the student experience than would have been gained from other forms of data collection, which seemed important in view of the lack of existing research into the use of word clouds. Focus groups created a space where students could largely control the conversation, consistent with a student-led approach to teaching.

In focus groups, students raised the issue of graduate attributes, and observed that their understanding of learning styles gave them knowledge about themselves and their understanding of word clouds gave them knowledge about the world outside themselves. The students commented that knowledge *management* skills, into which they classified word clouds, were critical in the workplace but currently ignored by universities, which concentrated on the knowledge itself. The literature on graduate attributes was accessed in response to focus group comments whereas the other literature outlined below provided the scaffolding for thinking about the role of word clouds in teaching and learning.

III. Literature Review.

In view of the lack of literature on word clouds, the focus in this section is on the literature that underpins this research on the approach to learning styles and teaching used, the importance of student ownership of learning techniques and word clouds as a workplace skill.

A. Learning Styles.

There are many approaches to classifying student learning style preferences (Byrne, Flood, & Willis, 2009; Dunn, 1984; Gardner, 1993; Haynes, 1998; Honey & Mumford, 1982; Lee & Hung, 2009; Marton & Saljo, 1997; Montgomery & Groat, 1998). The accounting students had previously completed Kolb's learning styles inventory as part of understanding their personal learning style preferences, so Kolb's four classifications of learning styles were used for this research. The advantage was that students understood Kolb's terminology so semantic differential issues did not arise in focus group discussions because there was shared meaning among the students and academic staff. Kolb's learning styles inventory has been criticised because it over-simplifies the complexity of learning accounting (McChlery & Visser, 2009) but McChlery and Visser (2009) could be criticised too. It was a two-country study that ignored cultural differences in learning and teaching quality, although these factors

are recognised as important to student learning and student motivation to learn (Leveson, 2004; Mitsis & Foley, 2009).

Kolb saw learners as having learning preferences described by two continua: a processing dimension ranging from active experimentation through to reflective observation, and a perception dimension ranging from concrete experience through to abstractive conceptualisation. This led to learners being defined by four categories representing the combination of their results on each continuum (see Figure 2). Kolb labelled the categories accommodating, assimilating, converging or diverging learning styles. Accommodators prefer concrete experiences and active experimentation. They manage hands-on, practical work well, particularly when they are able to undertake it themselves then build their understanding from their observations. Assimilators prefer to think something through and reflect on it. They are the students most likely to enjoy lectures as a form of learning. Although convergers conceptualise ideas, they then like to test the results with active experimentation, tweaking results until they are satisfied with them. Divergers prefer to move from concrete experiences to reflective observations. They are the students most likely to work from one practical example to thinking about how its results apply in other circumstances.

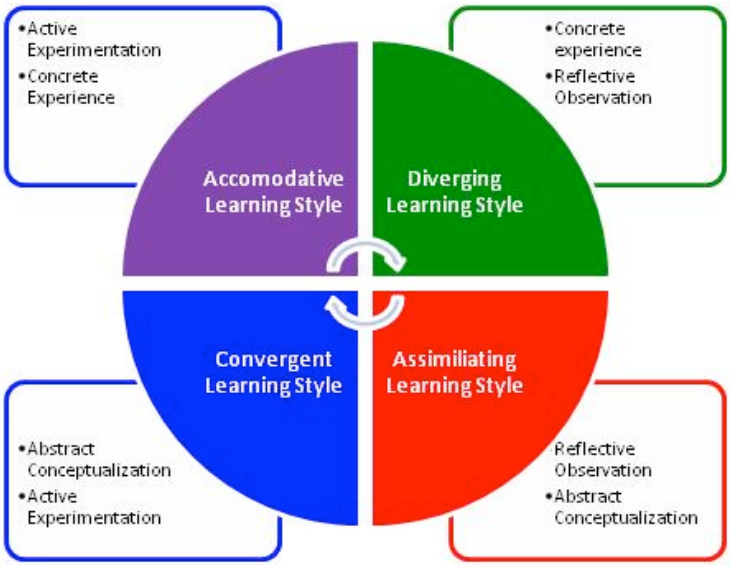

Figure 2. Learning styles: Source: David Kolb and Learning Styles, The Effective Development Leadership Community.

There is evidence that teaching materials should be presented in ways consistent with the learning style preferences of students to encourage students to engage in deep rather than surface learning.(Biggs, 1999; Entwhistle, 1981; Franzoni & Assar, 2009; Marton & Saljo, 1997). Although the dichotomy between deep and surface learning has been criticised as simplistic (Beatie, Collins, & McInnes, 1997), it continues to provide a useful way to understand and explain student approaches to learning (Lau, Liem, & Nie, 2008; Nelson Laird, Shoup, & Kuh, 2006). Some researchers include a third category called strategic learners (Gijbels, Segers, & Struyf, 2008; Papinczak, 2009). These are learners who will study in a deep way if a subject is set up so depth of understanding is required. Otherwise, they will only put in the amount of effort it takes to achieve what they perceive as a satisfactory result. It would seem unlikely that strategic or surface learners would bother to experiment with a learning tool so when the accounting students experimented with ways to

use word clouds more aligned to their learning preferences, it suggests they were engaging in deep learning. It is not suggested that their deep learning approach was due to the introduction of word clouds but simply that it appears consistent with such an approach.

B. Teaching Approach.

A constructivist student-led learning approach to teaching was used because it is recognised as providing a sound grounding for the workplace (Beckman, 1990). Students were introduced to learning style preferences for the same reason: it is recognised as knowledge valuable in a work environment (Boyle, 2005; Buch & Bartley, 2002; James-Gordon & Bal, 2001; Marsick & Watkins, 1990). This literature views any of the learning style models as workplace relevant because all provide deeper understanding about the workplace interaction.

A constructivist approach asserts that that learning should come from the student and not the teacher; the teacher's role is to create an environment in which the learner has the freedom to construct understanding (Baviskar, Hartle, & Whitney, 2009; Enghag & Niedderer, 2008; Gordon, 2009; Loyens, Rikers, & Schmidt, 2009). Teachers provide opportunities for students to build on prior experiences and learning, exploring possibilities and different solutions, learning as they solve problems (Derry, 1992, 1996; Steffe & Gale, 1995). Group learning techniques were used to encourage shared development of ideas. The constructivist approach has been criticized (Altun & Buyukduman, 2007; Liu & Matthews, 2005) but none of the criticisms invalidates the basic premise that the best learning is student led.

Students could elect to work in a group with students who had a similar learning style preference to their own (49 students), or different learning style preferences (20 students). From staff observation, groups with students who had the same learning style preference proved more harmonious than those with mixed learning preferences but tended to be less risk-taking in exploring uses for word clouds. The choices to work with like-minded peers or those who learn in different ways are of interest in themselves as they may give an insight into how groups function and explain why the group work by university students can be so unsatisfactory (Gottschall & Garcia-Bayonas, 2008) but that is not the focus of this research.

C. Student ownership of learning techniques.

Academic staff anticipated that introducing word clouds would motivate students to learn because it would was a new technique, easy to learn and a direct response to a need identified by the students. Motivated students are more likely to engage with all aspects of their learning (Ames, 1990; Brophy, 1986) and become responsible learners who take ownership of their learning (White, 1988). There is extensive research literature indicating that student learning is enhanced if students can be encouraged to take responsibility for their own learning (Enghag & Niedderer, 2008; Gibbs & Habeshaw, 1989; Gijbels, et al., 2008). They are more likely to do this if they are included in the process of how they learn, not just what they learn (Platz, 1994) and if their understanding has been developed from their own discovery (Borda, Kriz, Popejoy, Dickinson, & Olson, 2008; Boud, Keough, & Walker, 1985). The design flexibility of word clouds allows students considerable latitude in how they learn, customizing the design and in how to use the completed word cloud.

Student motivation is enhanced when they can develop alternative strategies or routes for attaining goals (Jones, Valdez, Nowakowski, & Rasmussen, 1995). Word clouds can be used in a variety of ways to learn but also, they have the flexibility of being able to be generated from any electronically available word content.

Motivation is a competence learned through factors including experience, understanding expectations, direct communication (Brophy, 1986) and influenced by extrinsic factors such as assessment weightings (Wormald, Schoeman, Somasunderam, & Penn, 2009). Since the creation of word clouds is giving students experience in selecting relevant content to summarize an electronic article, it should enhance motivation if students become enthusiastic about their use of word clouds.

Despite the acknowledged importance of student motivation in learning, this area is complicated by lack of an agreed definition (Ames, 1990; Maclellan, 2008; Marshall, 1987), inability to separate motivation from intelligence (Schick & Phillipson, 2009) and cultural factors (Matsumoto, 2009), and difficulty distinguishing motivation from other factors that make students responsible and engaged learners. There does seem to be a clear understanding that a motivated student is someone who is self-motivated to learn. If students adopted word clouds as a new learning tool when they were at the tail end of their degree studies and would be expected to have set study habits, this would suggest they were self-motivated and responsible learners. This is not meant to suggest that more motivated students would use word clouds more frequently or more creatively than less motivated students but that willingness to experiment would appear to be consistent with a motivated student. What academic staff did not foresee was how powerful word clouds as a learning technique would be because students could adapt them to individual learning preferences and that this would be evidence suggestive of responsible self-motivated learning.

D. Developing Workplace Skills.

Research has recognised the value in the workplace of a knowledge of learning styles (Marsick & Watkins, 1990). The global financial crisis has surely highlighted that business decision makers must be responsive to changing external and internal environments but how can they respond unless they remain current with relevant events, business strategies and responses? Long before the global financial crisis, this was recognized in the research literature as an important attribute for graduates to possess (Barnett, 2006; Barrie, 2008; Hager & Holland, 2006; Hager, Holland, & Beckett, 2002). Previously, research has not provided guidance on how to equip students to manage it. Word clouds are offered as a response technique. Perhaps universities do not seem to have responded the research literature in this area because of the lack of common understanding about what constitutes graduate attributes (Barnett, 2006; Barrie, 2004, 2007; Green, Hammer, & Star, 2009; Hager, 2006; Kember, Leung, & Ma, 2007), which attributes matter (Sutcliffe & Cummings, 2007), how to incorporate graduate attributes into teaching (Al-Mahmood & Gruba, 2007; Clarkson & Brook, 2007; Treleaven & Voola, 2008) and the difficulty of measuring graduate attribute development in students, particularly in how they contribute to developing lifelong learners (Chen, Hsu, & Wu, 2009; Hager & Holland, 2006; Manathunga, Lant, & Mellick, 2007; Manathunga, Pitt, & Critchley, 2009; Seethamraju & Borman, 2009; Ya-hui & Li-yia, 2008). This area is fraught with issues. Employers believe the attributes of graduates are not sufficiently broad and generic (Manathunga, et al., 2007) and that universities focus on lower level attributes that are easier to develop (Barrie, 2006), ignoring skills that enable students to build their careers (Bridgstock, 2009; Johnston & Watson, 2004), even though well-developed graduate attributes enhance student employability (Anonymous, 2009; de Janasz & Forret, 2008; Hager & Holland, 2006; Hager, et al., 2002; Ya-hui & Li-yia, 2008). Although there is ongoing debate about graduate attributes, it is recognised that students value more highly graduate attributes they have developed themselves (Wood & Smith, 2007), which would appear to create a justification for introducing students to word clouds. Technologically, they are a low level skill but since students must have a critical

understanding of an area in order to select the appropriate level of detail for their word cloud, the creation process involves higher level thinking skills.

IV. Student Response to Word Clouds.

In this section, student comments have been used that most accurately summarize discussions or which appeared to have general support from the other students. Students were also encouraged to submit comments by email or anonymously via a note or through another staff member, but preferred to participate in the open forum of the focus groups. Whether this preference was linked to their familiarity with speaking in a small group setting, due to the teaching style used, was not able to be assessed. However, it was apparent from the relaxed body language and casual tone of all focus group conversations that the students appeared comfortable speaking before their peers and the facilitator. In one group, students were asked if they wished to make a written record of any comments without the presence of the facilitator in the room and this offer was rejected.

When the students were introduced to word clouds as a learning aid, it was in the context of a challenge. Given a word cloud of a topic, students were asked whether it accurately represented the critical points of that topic. Students were keen to know how word clouds were created, so were shown how create word clouds from lecture notes provided as PowerPoints and internet sites. They were warned that word frequency did not necessarily reflect the importance of a word or concept. All students found this difficult to grasp. Later focus group feedback indicated that most students initially saw word clouds as a way to lessen the time spent engaging with materials but quickly discovered the opposite happened. They had to engage fully with the materials before creating a word cloud to ensure they could assess the quality of the word cloud and modify it as necessary. Some students felt tricked by this:

> I thought you were showing me something that would save me doing as much work, but I soon worked out that you can't do a good word cloud unless you really understand the stuff first. Now I find I'm really trying to understand what I read. I think you tricked us by giving us a fun thing to do so we'd think accounting was fun.

The student sent a follow-up email revising his opinion, saying he had "worked out that *even accounting* (his emphasis) is fun. Doing the word clouds helped make it fun".

Many barriers prevent students from using technology (Keengwe, Onchwari, & Wachira, 2008). To minimise barriers, time was spent ensuring students could create the word clouds quickly and felt confident technologically. No student reported difficulty creating word clouds or understanding the concept of a word cloud. Many (49 students) commented that the time devoted to teaching them how to prepare word clouds increased their enthusiasm for accounting by turning their learning into a game and a challenge. This was important feedback because in taking time to ensure all students could create word clouds easily, time had been taken that would otherwise have been used to teach additional accounting content. The feedback helped dissipate staff resentment about this use of time.

The majority of students (57) regularly used word clouds to summarise lecture notes, as had been demonstrated to them. Of the 12 students who did not regularly use word clouds to summarise lecture notes, four admitted that despite good intentions, their enthusiasm for all subjects had ebbed as the semester progressed and this regularly happened to them. They saw value in word clouds as a learning tool but were reactive not proactive learners, only putting in the bare minimum to pass each subject. The remaining eight students prepared word clouds except when assignments were due. These students acknowledged chronic time management problems. None of them achieved higher than a pass grade. This is not to

suggest that students who prepare word clouds achieve higher grades than those who did not, but rather that students whose study habits are disorganised or who fail to engage fully with their learning tend to receive lower grades than more motivated and engaged students, as would be expected.

A. Learning Styles.

A peer learning group comprising four mature age students used word clouds to summarise assigned readings and additional readings they found on the internet and in library databases. They would individually create word clouds, refining them until they felt their word clouds best expressed the most important aspects of the content, then exchange them and discuss differences among their individual word clouds. This level of proactive extension of the use of word clouds might reflect their maturity compared with the other students. They thought it reflected their work ethic, learned in the workplace and applied to their studies. Each of these students had thought about other ways that word clouds could enhance their learning. It had been a minimum of thirteen years since any of these students had engaged in formal study. One student commented that she felt a need "to do more, to hold my own with the younger ones", to quote her. These students all achieved high distinction or distinction grades (total marks of 75/100 or higher) for accounting and included the students who received the top two marks for the subject. All students in this group were accommodators.

Accommodators prefer to build on their experiences. Only accommodators commented that the workplace relevance of accounting became more apparent to them as they created their word clouds but their understanding of accounting as a discipline was primarily enhanced through their small group discussions which were based around their word cloud pictures. They referred to group learning synergies and were in agreement that collaborative approaches were more beneficial than competitive approaches. These students occasionally worked in self-selected pairs to prepare the word clouds that formed the basis of group discussions. They were strong advocates of the benefits of both collaborative and peer learning, viewing word clouds as a tool that facilitated collaborative learning and peer learning. Assimilators commented that they had assumed that when word clouds were introduced in class, there was an expectation that students would use the tool in other ways.

Although other accommodators in the class did not use word clouds as effectively as the four mature age students, all accommodators regularly explored additional uses for word clouds, making word clouds of additional learning resources or using word clouds to summarize lecture PowerPoints in other subjects. All accommodators used word clouds to build on their learning in some way, including assessing whether additional material seemed worth reading. These students spent considerable time altering their word clouds until they were happy that they accurately reflected the source material and they did not view this time as wasted.

Assimilators made word clouds of lecture notes and, in some cases, assigned readings. None of them made word clouds of additional electronic resources. All stated that they only did what was shown to them in class because "the lecturer knew best" so they did not see a need to go to additional resources. The assimilators spent considerable time tweaking the word clouds, particularly those of lecture materials, until they felt the word clouds reflected their understanding of the key lecture points. Although they brought their word clouds to group discussions, they rarely showed them with other group members, describing them as "personal" or "private" study aids. These students did not enjoy working in groups and were much more comfortable working alone. All viewed their lecturer as their primary knowledge source, even though this was contrary to the teaching philosophy in accounting and explained to all students. For assimilators, word clouds were primarily a tool

for individual reflection, and the process of tweaking their word clouds was the time when that reflection occurred. However they complained about the time they spent tweaking their word clouds, feeling that other traditional hand-written dot point summaries were faster to compile. These were the only students who did not refer to their word clouds at the end of the semester as part of their final examination revision.

Convergers liked to make word clouds of any assigned materials. Those who used word clouds to summarize material they had found agreed that this had assisted their learning. They enjoyed the time spent tweaking the word clouds, expressing very strongly that this time was not wasted. Convergers were vocal about the importance of tweaking their word clouds because they saw it as time spent in reflection. In particular, they enjoyed being able to use computers for this process. This is consistent with research indicating that convergers have a preference for computer mediated material (Buch & Bartley, 2002).

Divergers were particularly sceptical about the convergers' comments. As with the assimilators, the divergers used word clouds in subjects other than accounting. They rarely altered their initial word cloud but did spend time thinking about whether the completed word cloud represented key aspects of a topic. This contrasted markedly with convergers who reflected while tweaking their word clouds but rarely reflected on the content of the word clouds once they had completed them to their satisfaction. Convergers made judgments about the usefulness of word clouds as a learning technique the first time they created their own word cloud. They saw time altering a word cloud as time wasted. . As one student explained:

> While you are working on your word cloud and how you want it to look, you are constantly reviewing the material (summarized in the word cloud) in your mind. You go over and over it and then it starts to sink in more, and you start making links to other things you have studied and it all starts to make sense. After the group meets, you start thinking about what to change based on what they have said but why waste time altering the word cloud when you have sorted out in your mind what is right or wrong with it?

Students with the learning styles of converger and accommodator prefer to learn by active experimentation. Consistent with this, these students tended to talk more about the process of formatting their word cloud rather than the content of the material in it. This comment from an accommodator is typical:

> The best part was playing round with my word cloud. As I altered the words in it and kept changing their colours and fonts and how my word cloud looked, the words seemed to lodge in my brain, so by the time I had my word cloud the way I wanted it, I felt really confident that I understood the topic.

Divergers and assimilators viewed the process of creating word clouds as inseparable from understanding them. Table 1 summarises student approaches to using word clouds based on learning style preference.

Table 1. Pattern of word cloud use. Regular users are defined as those using word clouds for at least 10 weeks of a 13 week semester.

Learning Style Preference	Number of students working in groups with students with similar preferences	Number of students working in groups with students with dissimilar preferences	Regularly used word clouds as demonstrated in class	Regularly used word clouds in way(s) beyond those demonstrated in class
Accommodaters	15	8	23	23
Assimilators	13	2	12	0
Convergers	16	4	15	8
Divergers	6	5	11	10

B. Teaching Approach.

All students commented positively on the small group teaching approach and the usefulness of their word clouds as a basis for their contribution to small group discussions. In some groups, one student took responsibility for preparing word clouds rest of the group; other members took on other tasks on behalf of the group. The level of trust students had with word clouds prepared by other students was connected to their perception of the student who prepared the word cloud for the group. To quote two opposing views of students:

> (He) is the brightest student in my tute so I knew the word clouds would be great.

> The person who prepared our word clouds is really good at IT but not so good at accounting, so I guess the word clouds were OK but I would have preferred (student name deleted) to have done them because she's good at accounting.

The first comment was made by someone with a strong preference for an assimilating learning style. Just as assimilators tend to enjoy lectures and respect lecturers for their deeper knowledge of a subject, this student was happy to defer to the assumed deeper knowledge of another student. The second comment was also made by an assimilator, but one with a learning style preference that bordered on the diverger style. Divergers tend to be reflective and so it is not unexpected that this student would have thought about who might be the best person to prepare the word clouds for their group.

All students enjoyed being part of a learning group, even when members of the group had different learning styles. However, not all group members understood the learning benefits of collaboration, viewing it primarily as means of dividing labour in a subject rather than a way to reinforce learning and construct meaning in a group environment:

> The others in my group helped me with lots of things. I found accounting really hard … the hardest thing I've ever studied. But I'm good at IT so I did words clouds for us. It all evens out in the end. This was a way I could pay people back … do something for the group. I had to do my share.

C. Student ownership of learning techniques.

All students agreed that being able to customize word clouds increased their sense of ownership of their learning. As one student commented:

> It was mine … just all mine. Mostly at university, you are doing what everyone else does but trying to do it better so you get a high mark but I put time into making my word cloud special because it made me feel different … unique, I mean … individual. Because I played with getting it to look just how I wanted it to look, I had to work out which words mattered and why so I learned stuff without trying in the process.

D. Developing workplace skills.

Students unanimously agreed that word clouds were a useful workplace tool for summarizing information in addition to being a useful learning tool for present studies, although most regretted learning about word clouds so late in their degree. One student's comment encapsulates the general view:

> In philosophy we learnt that knowledge is power. Well, knowledge means having information and these days, most of it is easy to get because it is all on the internet. But who has time to read it all? I know that I can use word clouds to help me filter out what I'd be wasting my time on.

Over half of the students felt that they could not use word clouds in another subject unless the lecturer of that subject expressly encouraged it, even though they appreciated the benefits of word clouds as a learning tool. This attitude was troubling as it suggests many students are reluctant to be proactive learners unless they feel they have been given permission to go beyond perceived learning boundaries in a subject. The prevalence of such an attitude is outside the scope of this research but may be an important area for future research as it is important for all teachers to understand how their students approach learning.

The limitations of word clouds as a workplace tool were discussed. Students were reminded that word clouds tabulated word frequency, which could led to key points being missed. Despite this, all saw value in word clouds as a workplace information management tool. These comments summarize general feeling:

> But even if I read everything, I might miss some key point. In business, you can't sit all day looking on the internet in case there's some new thing you should know. Word clouds allow me to sift through a lot more information than I otherwise could if I had to read it all.
>
> In every subject I've studied, I've been told that I'm developing graduate attributes and I've never really understood what they are or what it is that I actually developed that I couldn't do before. Finally, I feel like I have developed a useful attribute. Word clouds have given me a tool that will let me get up to speed with any sudden changes, and change can happen really quickly, like when the global financial crisis happened. This has been the most useful graduate attribute I've developed and the university doesn't even call it one.

When asked to define the graduate attribute developed through creating and using word clouds, student responses were mixed. The most frequent descriptions were the ability to stay on top of relevant information (20 students) or manage it (39 students). Three students took a broader view, describing it as an aspect of change management or simply part of being a good manager. Seven students felt unable to name the attribute but agreed that they had learned a skill they could apply in the workplace. After much discussion, one of the more reflective students stated:

> Word clouds have empowered me so I feel I can take charge of my own learning. These days, to succeed in business, you need to be able to do that. I think the graduate attribute is being a workplace learner, not just a university learner.

This comment was well-received by other students. This student had grasped the concept of life-long learning without naming it as such. Research indicates the benefits of lifelong learning (Bath & Smith, 2009; Bauer & Gruber, 2007; Chen, et al., 2009; Hager, et al., 2002). The importance of developing students with an attitude that learning is a lifelong process has been officially recognised in Japan and by the European Union (Ogawa, 2009). Students considered the 2008 global financial crisis a critical event that highlighted the importance of business managers having through and complete knowledge and an ongoing ability to learn but added that word clouds were only a useful tool if managers already had the knowledge and experience to evaluate their usefulness.

V. Discussion.

A. Learning Styles.

The strong correlation between learning style preferences and the use of word clouds was unexpected. Since the students knew their own learning style preferences, had this conditioned them to use word clouds in ways that meshed with those activities? Although the students disagreed, it was difficult to accept that the alignment could be so clear-cut, particularly when many of the students were close to the divide between their learning style

preference and another learning style preference. If this suspicion is correct, it suggests that students might have subconsciously eliminated uses of word clouds that they considered inconsistent with their learning style preferences. However, since the student response to word clouds was strongly positive, perhaps what matters is that word clouds proved a valuable learning aid. Student feedback indicated that word clouds increased their motivation in accounting, giving them a sense of ownership of the discipline content because they could alter how it was presented.

B. Teaching approach.

All students participated in small learning groups to enhance peer learning. Students were encouraged to form their own groups. Although most students had settled into groups of students with similar learning style preferences, they viewed this as random assignment because they had not expressly discussed learning style preferences with other students before making their group selection. It is difficult to see it as completely because students had been encouraged to form groups where members had similar attitudes to and expectations about learning, plus similar study habits and these students had known. Groups whose members had mixed learning style preferences commented that there was considerable conflict about the use of word clouds; in one group, this remained unresolved. In the other group whose members had different learning style preferences, the views of the most dominant and vocal person were followed. Other members of the group expressed varying degrees of dissatisfaction about that outcome. They also expressed dissatisfaction concerning any discussions based around their word clouds, feeling that the vocal person set the parameters for these discussions and only his word clouds were used for discussion. Nevertheless, they all saw value in using word clouds to enhance learning.

Groups whose members had similar learning style preferences appeared more harmonious, with one exception. Since that conflict was about a member who regularly disengaged with his team-mates, it was not connected to the use of word clouds.

All students agreed that being part of a small group that met weekly had provided an impetus for preparing their word clouds because there was an expectation that members of a group would bring their completed word cloud to meetings. They could see the alignment between the constructivist approach to teaching and the introduction of word clouds as a learning technique.

C. Student ownership of learning techniques.

As with all aspects of student learning, there will always be some students who are not sufficiently motivated to engage fully with it. This research and the teaching approach used in accounting assumed most students want to engage in deep learning but do not always know how. Word clouds gave students a tool that assisted them to more fully engage with accounting. They provided a process for learning.

Students were adamant about three points. First, learning a *process*, such as word clouds, could engage them in a subject almost as much as engaging content could. Second, unless they could see workplace relevance of either content or a learning tool presented to them, students had less incentive to engage in deep learning, irrespective of the stated learning outcomes or lecturer's expectations. Third, there were two key drivers in student uptake of word clouds: being able to individualize it, whether by customizing the look of the word cloud or by using it for the purposes they chose, and the small group teaching approach, where they either had an opportunity to show their word cloud art for others to admire or where they could use their word cloud to aid their participation in discussions. Students were

also adamant that being able to create a unique word cloud gave them a sense of ownership of the word cloud *and the associated learning*. These results raise some important teaching related issues about the relevance for learning of teaching processes versus teaching content, the extent to which workplace relevance should impact on *how* we teach as opposed to what we teach, how we support students to feel they are unique while trying to teach a group of students and the role of teaching *process* in assisting students to take responsible ownership of their learning. How these issues are addressed will depend on the student demographic.

Students commented that being able to choose how to use word clouds to enhance their learning increased motivation to understand accounting and enhanced their sense of self as they were able to take ownership of the learning process. A developed sense of self appears to be a quality valued by employers (Walther & Radcliffe, 2007). It is paradoxical that a computer mediated processes appears to enhance something as personal as one's sense of self. Whether this is reflective of the age range of the students, the majority of whom "grew up with computers", is not known but it would be interesting to know the extent to which the sense of self of such students might in some way link to technology.

D. Developing Workplace Skills.

Perhaps it was because the students were due to graduate that they were particularly concerned to acquire skills transferable to the workplace so they were predisposed to view word clouds as a skill transferable to the workplace. The students described the knowledge base required for business management as fragmented, eclectic and constantly changing, and thought word clouds were ideally suited to give them some way of managing such information and the plethora of information available to them electronically. In that regard, word clouds met the purpose for which they had been introduced to the students.

The trade-off between giving accounting students competence in current accounting practices versus equipping them for the longer term is always problematic. In accounting, this trade-off tends to be viewed in terms of the discipline content taught, whereas this research suggests it should expand to include learning processes.

VI. Conclusion.

This research describes an attempt to meet student concerns about managing the quantity of information to which they would be exposed in the workplace. It explores the introduction of word clouds as a tool that would assist the students to summarize electronically available information in the workplace. It also explores word clouds as a tool to assist student learning.

The lack of a base of prior work on student use of word clouds to enhance learning necessitates this research being exploratory. This research indicates that students enjoy using word clouds and find them easy to use but more importantly, that word clouds have potential as a learning tool. Word clouds provide some flexibility both in design and in use. This research shows how a group of final year students took advantage of the flexibility in way's consistent with their learning style preferences. This gave them a sense of ownership of their studies, enhancing their motivation and engagement with their learning.

This research suggests that word clouds provide a useful adjunct to other learning strategies bit must be used with caution as they summarize word frequency and this may not align with word relevance.

There are always dangers in generalising from one small case study. This study involved a relatively small group of students and a relatively short time frame. However, the strongly favourable response by students to word clouds and flexibility of word clouds

suggest that this technique is worthy of inclusion as a teaching tool and that their use by students is worthy of further research.

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JOSOTL
JOURNAL OF THE SCHOLARSHIP OF TEACHING AND LEARNING

Mission

Founded in 2001, the Journal of the Scholarship of Teaching and Learning (JoSoTL) is a forum for the dissemination of the Scholarship of Teaching and Learning in higher education for the community of teacher-scholars. Our peer reviewed Journal promotes SoTL investigations that are theory-based and supported by evidence. JoSoTL's objective is to publish articles that promote effective practices in teaching and learning and add to the knowledge base.

The themes of the Journal reflect the breadth of interest in the pedagogy forum. The themes of articles include:

1. Data-driven studies: formal research projects with appropriate statistical analysis, formal hypotheses and their testing, etc. These studies are either with a quantitative or qualitative emphasis and authors should indicate the appropriate domain. Acceptable articles establish a research rigor that leads to significant new understanding in pedagogy.

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Style Sheet for the *Journal of the Scholarship of Teaching and Learning*

John Dewey[1] **and Marie Curie**[2]

Abstract: This paper provides the style sheet for the Journal of the Scholarship of Teaching and Learning. Manuscripts submitted for publication should adhere to these guidelines.

Keywords: radiation, metacognition, identity theory, constructivism, educational philosophy.

I. General Guidelines for the Manuscript.

The final manuscript should be prepared in 12-point, Times New Roman, and single-spaced. Submissions should be double-spaced. All margins should be 1 inch. The text should be fully left- and right-justified. The title (in 16 point bold) and author's name (in 12 pt. bold) should be at the top of the first page. The author's name should be followed by a footnote reference that provides the author's institutional affiliation and address. The abstract should be indented 0.5" left and right from the margins, and should be in italics.

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Pages should be unnumbered since they will be entered by the Journal editorial staff. We will also insert a header on the first page of the article, as above.

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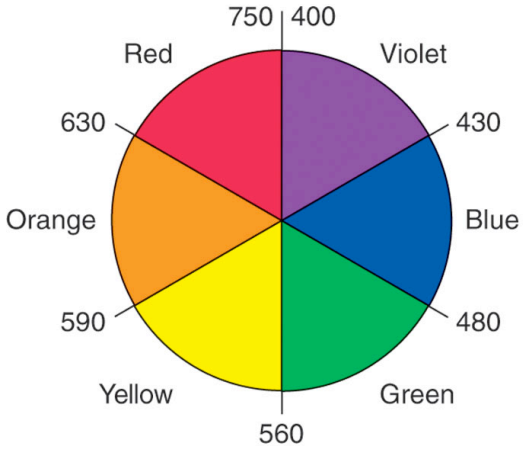

Figure 1. Color wheel with wavelengths indicated in millimicrons. Opposite colors are complementary.

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Appendix

Please insert any appendices after the acknowledgments. They should be labeled as follows:

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