Developing Active Learning Strategies for Online and Emergent Collaborative Technology Based Teaching: A Preliminary Report

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Abstract

Active learning strategies have been implemented and studied since the 1970's; however, investigation into ways of including active learning in the virtual environment has not been extensively conducted. Active learning techniques have been shown to improve content retention and understanding of concepts (Cherney, 2008; Michael, 2006). This paper provides a description of active learning strategies designed or adapted for online classrooms by the authors as a first step towards the development of appropriate active learning pedagogy for use with on-line instruction and emerging technologies. The strategies discussed here employ emerging collaborative software as well as new technologies for teaching technical graphics concepts. Several different strategies are presented along with challenges encountered during classroom implementation, suggestions, and modifications for the next phase of this study. A discussion of students' reactions to each strategy is provided.

Introduction

Active learning is a well-established set of teaching strategies for face-to-face instruction in classrooms. Elements of active learning have been defined as instruction during which: students are involved in more than listening; there is an emphasis on developing students' skills; students are involved in higher-order thinking; students are engaged in activities; and instruction emphasizes students' exploration of their own attitudes and values (Bonwell & Eison, 1991). Best practices for online instruction seen in recent literature include a focus on interactivity, skillful use of technology, and a clear understanding of both technical and interpersonal expectations (Tremblay, 2006); as well as providing prompt feedback, increasing time on task, and adapting instruction to the needs of diverse learners (Hastie, Chen and Kuo, 2007). Dickenson, Burgoyne and Pedler (2010) defined Virtual Action Learning (VAL) as "action learning which takes place in a virtual environment . . . via a range of enabling, interactive and collaborative communication technologies." The importance of effective design knowledge-sharing as well

as methods for promoting collaborative design learning were explored by Wang, Shih, & Chen (2010). The authors have proposed that pedagogic strategies for active virtual learning can be drawn from the existing active learning paradigm and modified to capitalize upon the unique strengths and challenges of the online classroom environment. This paper explores active virtual learning strategies specific to teaching graphic content as well as some collaborative leaning that utilizes new technologies; however, the strategies discussed here are broadly applicable to virtual instruction.

The authors realized that to provide students with active learning experiences as part of online instruction as well as with newer technology, they would have to design their own activities that provide this type of instruction and test them as part of courses they teach. Thus far, the authors have undertaken step one in this process. Beginning with courses taught during the Summer of 2012 and continuing into the early fall semester, active learning strategies have been designed and piloted, and student feedback has been gathered. The next phase of this work will comprise systematic examination of these activities for their effectiveness on a larger scale. Active virtual learning activities were developed for high school students, undergraduates, and graduate students in online and hybrid Technology, Engineering and Design Education (TDE) and Visual Art courses for the purpose of teaching concepts essential to the study of technical graphics in a virtual environment: visual ideation, graphic design software fundamentals, collaborative design development, critical analysis of design principles, and graphics as a means of communication.

Method 1

Virtual Active Learning Strategies Employed in Higher Education-Think Pair Share: Curricula for Emerging Technologies is an interactive online graduate course at North Carolina State University (NCSU). Students in this course analyze current technological advancements and develop appropriate instructional programs, including applications for emerging technology-learning activities. Employing the *Think Pair Share* active learning strategy, participants constructed a case study. The lesson focused on the concept that "Technological knowledge and processes are communicated using symbols, measurement, conventions, icons, graphic images, and languages that incorporate a variety of visual, auditory, and tactile stimuli" (International Technology and Engineering Education Association, 2000/2002/2007, p. 174). Students were asked to individually examine Standard 17, Benchmark Q, and then conduct initial research to gather ideas for emerging technologies from within the past two years (*Think*). Students then chose partners with similar ideas and interests (*Pair*). Pairs were required to conduct further research on the chosen emerging technology, and then layout an electronic storyboard. They then designed a VoiceThread presentation, complete with audio overlay, for colleagues to view on their own (*Share*).

Results

A brief survey was created to gather students' general perceptions of the *Think Pair Share* activity and to solicit suggestions for improving both the activity and the survey. Feedback indicated positive responses

for the strategy of the activity. Overall, students more than agreed that the directions were clear; the activity aligned with course content; improved content knowledge; improved ability to recall the material; collaboration helped acquire content information; and they would like to participate in more *Think Pair Share* activities. Improvement indicators included wanting more details on the strategy itself. When asked to comment on whether they would participate in more *Think Pair Share* activities, one student enjoyed the collaboration for sharing ideas and defining project expectations from multiple viewpoints. Another reported previously employing the strategy in the classroom to encourage student collaboration.

Method 2

Visual Ideation Activity — Desktop Publishing and Digital Media Course (TDE 205): The TDE 205 course at NCSU provides instruction in development and layout of print documents for effective communication. Part of the Technology, Engineering and Design Education program in the Department of Science, Technology, Engineering and Mathematics Education, this course involves instruction in Adobe Illustrator, Photoshop, and InDesign as well as a basic understanding of layout design, color theory, typography, readability, camera operation, image editing, and printing methods. New technology and collaboration processes were employed with students during the logo/label design project in Adobe Illustrator CS6. Project specifications were as follows: 1) The logo must be developed collaboratively, with documented contributions from all group members using a variety of tools; 2) Individually, a student must create a product line for the two containers and an external container of some type (for example: a soft drink container and a carry case for a pack of drinks); and 3) Each set of labels must incorporate all the elements normally found on that type of product (bar codes, ingredient lists, warnings, manufacturer's address, recycle symbols, directions, etc.).

Students were placed in groups of two to three and assigned to create a fictitious company's logo as well as decide on a company "look." Each student then, in consultation with the members of their group, developed a product line for their fictitious company. Formative feedback was built into the product line development timetable through informal presentation and group discussion. Students entered Multidraw rooms within the www.Queeky.com environment, a collaborative tool allowing students to simultaneously work on a single drawing. Students used this program as an ideation tool for their company's logo design. Students also used the Wacom Inkling and the Wacom® Intuos 5 Touch tablet and stylus for ideation and logo development.

Results

Student feedback was documented in two ways: 1) a set of discussion forum posts in the course Moodle site was assigned as a format for documenting and discussing the ideation process; and 2) students were asked to complete a survey, built in Google Forms and distributed via Moodle, of their experiences using the project hardware and software for the logo development portion of the logo/labels project. Forum posts included screenshots of ideation and logo development that occurred using Queeky Multidraw, the

Inkling, the Intous5 tablet and stylus, and Illustrator. Brief descriptions and annotations were interspersed with images, and students commented constructively about their peers' design development.

The Multidraw feature proved frustrating to students due to a multi-user time delay, the lack of "an easy undo feature," and a tool selection and interface deemed "subpar" compared with the more advanced features available in the Adobe Creative Suite. Ninety-three percent of students reported that it "functioned sporadically." However, students recognized benefits unique to the simpler collaborative application: 66% of students agreed/strongly agreed that the software was appropriate for collaboratively developing design ideas. Asked to list positive aspects of the software, they said, "great for ideation," "a good tool to make sure that we all knew what we were leaning towards in the design. It seemed to help us work as a group better," and "it allows you to share your ideas with your team without having to be in the same area."

Students responded quite favorably to their experiences with the Wacom Inkling. Ninety-three percent of students agreed/strongly agreed that the software was appropriate for collaboratively developing design ideas. Chief complaints tended to reflect students' inexperience with operating the pen: "Sometimes what I drew didn't show up on the computer," and "if the light goes out during an elaborate sketch you might have to redo all your work." Praise for the Inkling tended to refer to ease of use, the benefit of drawing directly on paper, and the increased level of control compared with other input devices: "We could collaborate and discuss ideas without the logistic limitations of a computer."

Responses to the Intuos5 tablet and stylus were similarly favorable. Ninety-three percent of students agreed/strongly agreed that the software was appropriate for collaboratively developing design ideas. Students appreciated the Intuos5's direct input to the software (whereas Inkling sketches required the upload and transfer of files). They noted challenges, often related to experiential differences between drawing on directly on paper and on the tablet surface: "It's just not the same as drawing on paper."

Method 3

Virtual Active Learning Strategies Employed With a Virtual High School: As part of a virtual high school course, several online active learning strategies were tested during a summer session. Over three weeks of the course, the following activities were used, with the introduction of a new activity to each weekly synchronous session:

- *Brief concept review followed by an evaluative "All Write" period (Harmin & Toth, 2006) and group discussion*: To begin the weekly synchronous class meeting, previous concepts were reviewed and briefly discussed. An image was displayed for a two to three minute "All Write" period. Students were asked to evaluate the image in terms of those concepts, and to simultaneously type their responses in the text window. This was followed by a group sharing/discussion session.
- *Partner-based evaluation and sharing:* Students were assigned to teams of two and asked to share and peer-critique designs in a synchronous collaborative sub-group. They evaluated each other's designs based on a list of specifications and constraints and then presented the designs they determined to be their best to the whole group.

- *Audio-enabled group drawing session*: Students were assigned to collaborative drawing "rooms" in which the audio function was enabled. Small groups were asked to verbally communicate to ideate and solve a design problem.

Results

The summer trial was fraught with logistical issues due to at least two factors not uncommon to online instruction: 1) although students were required to attend the synchronous sessions, many did not; and 2) some students who did attend the sessions chose simply to not participate. Despite poor attendance and participation, however, some observations were made that informed recommendations for the fall semester course for virtual high school students.

The concept review/"all write" period produced successes measured by active participation, evidenced by students' typed responses in the group text chat box, from all 4 students in attendance (out of the total class enrollment of 19). After being provided with one example of how the instructor thought implied, directional lines were affecting the movement of the viewer's eye across an image, all students applied at least moderate concept understanding to another image presented on the screen. This review and formative assessment are valuable methods for ascertaining students' readiness to move forward into successive content. Providing a sample response as well as an alternative problem to the sample is advised. Having remedial materials available is likewise prudent.

Partner-based evaluation and sharing was adapted for the three students present at the second of the three sessions. Students worked as a single small group, discussing the appropriateness of the single design that was brought to the class session. The consensus-reaching piece of the activity was not viable in this situation. As a result, the assignment of groups prior to the synchronous session for improved attendance and sense of responsibility to classmates was a strategy used later in the fall semester.

The audio-enabled group drawing session was by far the most highly favored of the three activities by students; two of them reported staying in the Multidraw room sketching and texting for well over an hour past the end of the synchronous course. High levels of engagement and relationship building are desirable outcomes in active online learning, though it is unclear whether the students were achieving course objectives while doing so.

Discussion

Although these activities were intentionally used for lessons in a variety of courses, their applicability to technical graphics education is of particular interest. One promising context for testing is a collaborative LEGO® project that ultimately uses SolidWorks to create new versions of existing LEGO® toys. A project used by a number of instructors of NCSU's introductory engineering graphics course (Foundations of Graphics—GC 120), students could use the Wacom® Inking, Intuos5 Tablet or www.Queeky.com during the collaborative ideation phase of this project. The effectiveness of input methods and devices is likely to affect concept mastery. Ideation and design refinement will likely be enhanced by more sophisticated collaborative drawing tools. As institutional offerings evolve to include hybrid and online instructional models, the delivery of technical graphics instruction will need to evolve accordingly. Almost any graphics

course that includes problem solving could benefit from the use of the technologies and active learning techniques explored in this paper. Likewise, learning new concepts and reviewing concepts in graphic courses could utilize the Thing Pair Share strategy as well.

Conclusions

Student mastery of technical graphics concepts in the virtual classroom is influenced by the convergence of many factors including software capabilities, available input devices, and instructional strategies. Students who participate in these active learning activities will continue to be surveyed for their opinions on the activities' effectiveness, ease of use, and areas where the strategies require or could use improvement. Use of active learning strategies tried online thus far has already yielded some insights that will be implemented in the future when they are revised and examined for effectiveness. The adaptation of active learning to virtual online instruction requires that they be recreated for this environment and thoroughly tested. This paper discusses a work-in-progress, so findings reported here represent the first phase of the activity developments. A final report of the effectiveness of these activities will be the next step in this research. As classroom formats evolve to include hybrid and exclusively online approaches to teaching and learning, the field of technical graphics education stands to benefit from the development and continued testing of appropriate new instructional models.

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