COLLEGE ALGEBRA STUDENTS' PERCEPTIONS RELATED TO PARTICIPATING IN COMPUTER-AIDED INSTRUCTION

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Researchers conducted a study to explore student experiences in a College Algebra course redesigned to incorporate the use of a computer delivery system. In the first part of the study, Aichele, Francisco, Utley, and Wescoatt (2011) investigated how students utilized learning resources in the redesigned course. This paper presents initial findings related to the second part of the study, exploring students' perceptions of learning in a hybrid learning environment.

Rationale for the Study

At universities across the United States, most mathematics courses are typically taught using a lecture-based format. Students tend to expect this type of format and may be uncomfortable when changes that challenge the norm occur. During 2007-2008, researchers began to informally investigate a redesign of the College Algebra experience at their large Midwestern land-grant university. Like many similar-sized institutions, the College Algebra program at this university enrolls approximately 2000 students annually as one of the entry-level mathematics course options. Course instruction may be

characterized as traditional; experienced non-tenure staff teach large sections (approximately 100 students), with lectures delivered in three 50-minute class meetings per week. Some of the motivations for considering a redesign included such issues as: (1) less than desirable student success rates; (2) high student drop rates; (3) variability among sections and semesters with respect to grades assigned and content expectations; and (4) controlling costs of course delivery.

The investigation and resultant discussion guided the subsequent redesign effort. Using technology offered possible solutions to the issues at hand. Most importantly, the use of computers offered hope for increasing student learning. Augmented by online resources and instant feedback, the course could become a more active experience for students, with most of their time spent doing mathematics rather than passively watching mathematics. Evidence from other universities suggested that such changes can increase success rates and decrease drop rates (Twigg, 2003). Anticipated secondary impacts of the redesign included reducing variability among sections and lowering delivery costs. Since most coursework could be delivered online, all sections could work on comparable assignments and have similar grading standards. Automating some tasks with a computer projected to reduce costs, as each instructor could teach more students per section.

The purpose of this study was to explore the thoughts and feelings of students participating in a computer-aided section of College Algebra. Thus, the guiding questions for this study are:

- How did students initially think and feel about participating in a computer-aided section of college algebra?
- Near the end of a full semester, what were student's thoughts and feelings about participating in a computer-aided section of college algebra?

Methodology

Setting

With the support of NCAT's Colleagues Committed to Redesign program, the mathematics department redesigned 8 of its 27 sections of College Algebra during Fall 2008. Each of the 8 redesigned sections met one time per week for 50 minutes in focus groups limited to 25 students (as contrasted with the regular sections that met three times per week for 50 minutes with enrollments of 50 students each). During these sessions, instructors reminded students about deadlines and course expectations, answered questions about the previous week's work, and previewed the upcoming week's content. Connecting with students once per week was viewed as important for keeping them organized and for maintaining a sense of class. Weekly task lists were also developed that provided a roadmap of tasks that the students should complete during the week.

In addition to the required focus group sessions, students in the redesign sections were also required to spend three hours per week in a computer lab which was open 60 hours per week and staffed by instructors and undergraduate tutors. While in the lab, students

used the MML help features, videos, and online textbook to learn the week's content and to complete their homework and quizzes. The primary goal of the redesign model was shifting students' time from passively attending lecture to actively working on mathematics.

The department chose an online course from MyMathLab (MML), produced by Pearson Education, in part because it includes a wide variety of resources to help students learn the course material. When students are working on homework problems, there are links to many of these resources on their screen. Students could choose from among the resources for a specific topic or problem: View an Example (a detailed, written solution to a similar problem); Help Me Solve This (an interactive, written tutorial that steps students through a problem and requires them to answer intermediate questions); Textbook (an online copy of the relevant textbook section); Video (a video lecture about the relevant topic or problem); Animation (a narrated animation about the particular topic or problem).

Participants

Near the end of the fall 2008 semester, members of the research team visited each focus group and described the study. Students who chose to participate were given class time to complete a survey. Of the 319 students still enrolled in redesigned sections at that point in the semester, 250 returned the completed survey resulting in a 78.4% return rate. According to their responses to background questions on the survey, the median age of the participants was 18.8, and this class was the first math course at this university for almost 90% of them. Approximately 65% of the participants identified themselves as Caucasian, 5% as Hispanic, 3% as African American, 3% as Native American, 2% as Asian, and 2% as having multiple ethnicities. The remaining 20% either did not indicate their ethnicity on the demographic survey or did not complete the demographic survey. Additionally, participants included 54% females, 32% males and the remaining 14 % did not indicate their gender or did not supply us demographic information.

Data Collection and Analysis

A couple of weeks prior to the end of the semester, each participant completed a survey consisting of two open-ended questions dealing with their thoughts and/or feelings about taking a MyMathLab section of College Algebra at two critical points in time during the semester: during the first week and at the end of the semester. The research questions were stated as follows:

> Q1: Think back to the first week of class. What were your thoughts/feelings at that point in time about taking a MyMathLab section of College Algebra?
>
> Q2: Now that you have nearly completed an entire semester, what are your thoughts and feelings about taking a MyMathLab section of College Algebra?

First, participants' responses to these two open-ended questions were analyzed independently by five researchers and placed into categories based on whether their responses were positive, negative, or neutral with a mixed category emerging. Researchers then met to discuss their individual codings. Any discrepancies in the codings were discussed and a consensus reached.

Second, for the positive statements, a constant comparative methods of analysis (Strauss & Corbin, 1998) was used and a list of agreed upon themes emerged from student responses. Researchers met again and discussed individual codings within the positive statements. Again, any discrepancies in the codings were discussed and a consensus reached.

Third, this same process of looking for themes was repeated for the negative and neutral themes as well as for the mixed category.

Results

Participants' Initial Thoughts and Perceptions

The researchers examined the participants' thoughts about participating in a College Algebra course using MML and meeting 50 minutes a week with an instructor. Four large categories for their responses were identified: Positive, Negative, Neutral, and Mixed. For those responses coded Positive, nine themes were then identified that characterized and elaborated on the responses in this category. Similarly, seven themes were identified for the Negative response category, and three themes were identified for the Neutral response category. A summary of these themes together with clarifying words and phrases and the number of responses (percentages) are provided in Table 1.

Participants' End of Semester Thoughts and Perceptions

Near the end of the semester the researchers again examined the participants' thoughts about participating in a College Algebra course using MML and only meeting 50 minutes a week with an instructor. Four categories of responses were identified: Positive, Negative, Mixed, and Neutral. The responses coded Positive were classified into six themes and the responses coded Negative were classified into eight themes. The Mixed category consisted of responses that were a combination of positive and negative statements that were representative of the themes identified in the Positive and Negative categories. The Neutral category contained responses that could not be coded positive or negative. A summary of the categories and themes identified along with clarifying words and phrases and the number of responses (percentages) are provided in Table 2.

Discussion

In summarizing the participants' positive initial thoughts and perceptions (about 37%), the three most common themes cited were the use of technology (the computer and other

online sources), the reduced number of whole class meetings, and the notion that this delivery would be easier (in relation to effort expended for a successful outcome or managing the course expectations). Perhaps these students interpreted the expectations of this blended delivery of college algebra to mean that instead of attending regular classes they would be doing their work online which would be easier for them. From these comments it appears that these students were open to this delivery mode as an alternative to traditional instruction models and perceived some advantages to it.

The top three themes that emerged from the participants who reported negative initial thoughts and perceptions (about 47%) included the use of technology, confusion about the logistics of the course (overwhelmed by all of the course information provided during the first week of the course), and the course structure would reduce the amount of interaction with others. It may be that these students were apprehensive about an instructional model that deviates from a more traditional one where they have regular human contact with the teacher and their work is prepared/graded the instructor.

Summarizing the concluding thoughts and feeling in the positive category (about 48%), the top three themes still included the use of technology and the design of the course. However, students cited the learning aspect more frequently. Perhaps having actually experienced the course for nearly a semester allowed participants to realize that they could learn using a different delivery system; they could be more autonomous in their learning.

For the concluding negative thoughts and perceptions (about 36%), one of the more frequently mentioned themes emerging from the participant responses again included the use of technology. However, the most frequently mentioned negative response involved preference for a traditional mathematics course. This preference may have been affected by the use of computers, the requirements within the course, or the course structure.

It is interesting that both the positive and negative codings in the initial and concluding responses resulted in high percentages associated with the emerging theme related to the use of technology; some viewed it as an asset while others viewed it as a liability. This may be a reason for institutions to allow choices among various delivery models, a reason supported by the preference for traditional delivery models displayed near the end of the course.

References

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Table 1.

Initial Thoughts and Feelings about Participating in a Computer-aided College Algebra Course (N=244)

Themes	Clarifying Words/Phrases	N (%)*
Positive		**96 (37.5)**
Use of technology	Mentioned, or implied, use of the computer or some online resource	36 (37.5)
One "class" hour	Made a reference to a reduced number of whole class meetings	32 (33.3)
Easier	Easier in relation to effort expended for a successful outcome *or* managing course expectations; includes phrases such as saves time	25 (26.0)
Flexible - more convenient	Made references to working on my own time in the context of time management and flexible schedule	14 (14.6)
Generally enthusiastic	Response was overall positive indicating optimism or excitement about the prospect of the course without further elaboration	10 (10.4)
Independence - teach yourself	Made references to working on their own or teaching themselves	7 (7.3)
New and Different	Positive statements indicating the experience was new to the student and different from earlier mathematical experiences	7 (7.3)
Human Interaction	Human assistance in the learning process	5 (5.2)
Negative		**121 (47.3)**
Use of technology	Any negative reaction to using a computer or to taking a course online; Students were skeptical, hesitant, nervous, scared, uneasy about learning online.	41 (33.9)
Confused	Comments in this category typically conveyed confusion about the logistics of the course. Some students didn't elaborate on why they were "confused," but others expressed that they were overwhelmed by all of the course information during the first week.	29 (24.0)
Human interaction	Students expressed concern that the course structure would reduce the amount of interaction with others. Some mentioned that the course	28 (23.1)

	structure would force them to teach themselves.	
Generally negative	Negative statements that indicated the students were skeptical, apprehensive, nervous or a generally negative comment about the prospect of the course without further elaboration.	18 (14.9)
Three “Lab” hours	Negative statements that related to requiring them to go to the "Lab" three hours each week was an excessive expectation.	17 (14.0)
Difficult	Difficult in relation to effort expended for a successful outcome *or* managing course expectations; includes phrases will require more effort or would take a lot of time; but not necessarily that it would be more difficult	16 (13.2)
Didn't know I was in a computer section	Negative statements indicating they had not realized they had selected a computer-aided section of College Algebra	16 (13.2)
Neutral		**24 (9.4)**
New and Different	Students express a general uncertainty related to their success and/or the expectations of the course	14 (58.3)
Didn't know I was in a computer section	Students stated that they did not realize they were enrolled in a computer section	8 (33.3)
Indifferent	Expressed no real opinion; did not care or stated they were indifferent	2 (8.3)
Mixed	Students’ responses were a combination of positive and negative statements representative of the categories listed above, but whose responses could not be coded strictly as positive or negative.	**13 (5.1)**

*Note: The percent listed in bold for the categories of Positive, Negative, & Neutral represent the percent of all statements; while the percents listed for the themes under each category represent the percent of respondents whose response fell within in that theme. Note that a respondent’s response may have fallen into multiple themes under a particular category.

Table 2.

Thoughts and Feelings after Participating in a Computer-aided College Algebra Course (N=237)

Themes	Clarifying Words/Phrases	N (%)*
Positive		**114 (47.7)**
Use of technology	Students indicated they liked learning from the computer; the instant feedback; the multiple tries on homework problems; the resources and features available; and the feeling of being organized.	46 (40.4)
Learning	Students enjoyed the independence that they felt from teaching themselves. Students also liked collaborating and learning from others. Expressed the feeling that MML fit their learning style.	38 (33.3)
Course Design	Students expressed liking the way the course was set up such as being able to retake quizzes and that assignments were due at midnight.	36 (31.6)
Generally positive	Responses were overall positive indicating they enjoyed the course without further elaboration	23 (20.2)
Human help	Human assistance from tutors and instructors aided in the learning process.	18 (15.8)
Flexibility	Students expressed the idea that they could complete the work at a time convenient to them.	12 (10.5)
Negative		**85 (35.6)**
Prefer Traditional	Students held a desire to never take a computer-based course again. They also expressed a desire to have taken a lecture-based course, feeling they would have learned more.	33 (38.8)
Use of Technology	Computers were too picky, requiring precise forms for the entered and were. Students disliked computer-based exams as computers could not issue extra credit as a human grader could. Students also held a general distaste for working homework online and the MyMathLab program.	27 (31.8)
Learning	Students learned very little in the course, and they had to teach themselves the material.	23 (27.1)
Course Requirements	Students dislike the homework/quiz prerequisite and going to a fixed computer lab location for	22 (25.9)

	three hours per week.	
Relationship between Technology and Learning	Students explicitly perceived a negative relationship. Students learned little from the course due to guessing on multiple choice questions or using the step-by-step helps offered by MyMathLab. Also, the program did not match learning styles; students could not learn from the computer.	17 (20.0)
One-50 minute class	There was not enough time in the classroom setting to learn.	17 (20.0)
Human help	Help from humans was deficient in availability and/or quality. Responses also indicate a preference for one-on-one help	6 (7.0)
Generally negative	Students held a generally negative opinion of the course without further elaboration.	3 (3.5)
Neutral	Students' responses could not be coded as positive nor negative.	**7 (2.9)**
Mixed	Students' responses were a combination of positive and negative statements representative of the categories listed above, but whose responses could not be coded strictly as positive or negative.	**33 (13.8)**

*Note: The percent listed in bold for the categories of Positive, Negative, Mixed & Neutral represent the percent of all statements; while the percents listed for the themes under each category represent the percent of respondents whose response fell within in that theme. Note that a respondent's response may have fallen into multiple themes under a particular category, but they fell into only one category.