CLICK, VIEW, ACTION! TOOLS FOR LEARNING IN A COLLEGE ALGEBRA HYBRID COURSE

Denise Natasha Brewley
Alvina J. Atkinson
Barry D. Biddlecomb
Georgia Gwinnett College
School of Science and Technology
1000 University Center Lane
Lawrenceville, Georgia 30043 USA
dbrewley@ggc.edu
aatkinso@ggc.edu
bbiddlec@ggc.edu

ABSTRACT

Teaching hybrid courses has become a growing trend in colleges and universities. At many undergraduate institutions, college algebra courses have been offered in a hybrid-format as an alternative instructional option for a changing population of students who need in class meeting times. What tools increase student success in college algebra hybrid course format? A possible recipe for success is the inclusion of student response systems, video lecture capture, and appropriate activities that engage students. Student response systems, also known as clickers (click), can be used to enhance the learning environment of students in hybrid courses, while giving educators immediate feedback on how students are grasping concepts. Video capture (view) gives students an opportunity to revisit concepts they want to review or might have misunderstood that were previously explained. Finally, in-class student engagement activities (action) that are carefully selected can keep students on task and shift their perspective about learning mathematics. In this paper, we will provide best practices for using these types of student engagement approaches in a college algebra hybrid-format that we believe promotes learning.

INTRODUCTION

The face of first year mathematics courses in colleges and universities is changing. Historically, students come to class, listen to their professors' lectures about topics, and then are expected to do any number of tasks to demonstrate that learning has taken place. Undergraduate institutions that offer early mathematics courses are adding other options in course formats to accommodate more students and different types of learners. Many colleges and universities are adding the hybrid-format to courses like college algebra to service a growing and diverse student population (Bonk et al, 2006). According to (Tallent-Runnels et al, 2006) in the academic year of 2000-2001, 90% of public 2-year and 89% of 4-year offered some distance-learning course. It predicted that this trend would increase annually (Young, 2002).

In addition to providing flexibility for when and how students can take mathematics courses, the hybrid-format can also provide a different educational experience to students. As institutions continue to offer hybrid courses, the question should be asked, "What tools are useful for students to be successful in a college algebra hybrid course format?" This paper will explore the use of student response systems (click), video lecture capture (view), and in-class student engagement activities (action) as tools for learning in a college algebra hybrid course. We will begin with a brief overview of the authors' institution followed by and description of hybrid-format courses.

BRIEF OVERVIEW OF AUTHORS' INSTITUTION

In 2006, the authors' institution became the newest undergraduate institution in a southern university system of colleges and universities. As an open access college, it serves a growing and diverse student population with limited admission requirements. Moreover, with a growing trend of working professionals re-entering higher education (Education Encyclopedia, 2011), the authors' institution also serves both traditional and non-traditional students. Many non-traditional students have a unique tension when returning to college. They are often older and have careers, may be in the midst of raising families, and not always able to attend classes on campus several times during the week. In response to a growing number of these kinds of students who have very unique educational needs, the authors' institution created hybrid-format courses to serve this population.

WHAT IS THE HYBRID-FORMAT?

The hybrid-format (Young, 2002), also known as blended learning (Kerres & DeWitt, 2002; Osguthorpe & Graham, 2003; Picciano, 2006), typically consists of traditional course components, such as lectures and in class activities, combined with an online course component, where students meet synchronously or asynchronously to complete online learning activities, such as discussions, quizzes, and exams. There is reduced face-to-face time with students in exchange for time that they spend online doing course work (Garnham & Karleta, 2002; Sands, 2002). In some hybrid-formats, students are only required to meet on campus one day per week, while in other formats, face-to-face time is reduced by a fraction of the time that a traditional course would typically meet. The primary goal of the hybrid-format is to combine the best components of teaching a face-to-face class and teaching online, while still maintaining an active and engaging learning environment for students. Although research is limited on hybrid courses (Tallent-Runnels et al, 2006), some scholars argue that teaching online can be a better experience or more effective for students than just in-class sessions (Driver, 2002; Dutton, Dutton & Perry, 2001; Maki et al, 2000; Singh & Pan, 2004; Thirunarayanan & Perez-Prado, 2001/2002).

Why Hybrid-Format as Opposed to Just Online?

There are several benefits to students taking and educational institutions offering hybrid-format courses as opposed to a course offered completely online. It is quite an attractive model from a student perspective because there is reduced seat time. It is also an attractive model from an institutional standpoint because several students can be enrolled for one course at any given time (Ward, 2004). Some additional advantages include having all the benefits of an online course, with access to a real instructor (Faux & Black-Hughes, 2000). Because time in the classroom is reduced, hybrid-formats also allow students more schedule flexibility to complete assignments and take other courses. In hybrid courses, students that are not as technologically savvy have the opportunity to improve upon these skills with the aid of an instructor to provide directed guidance when necessary. Finally, students who are independent learners can work individually navigating the online environment, but then work collaboratively with other students to complete group assignments and projects (Ward, 2004).

EXISTING ISSUES WITH HYBRID LEARNING AND HOW THEY CAN BE ADDRESSED

While there are number of advantages for the hybrid-format, there are also some concerns with teaching online. Some educators have suggested that there are some potential issues with online learning in general and the hybrid-format in particular. Burgan (2000) raises several concerns

with teaching online courses from a pedagogical and technological perspective. From a pedagogical delivery standpoint, there is concern that important course content may be diminished in relevance or may lack complexity and depth because of the shortened meeting time and lack of interaction by participants. This is echoed by Tallent-Runnels et al (2006), which discuss the importance of instructor presence in online courses not only to guide students' knowledge construction, but also to give breath and depth to discussions about content. In the case of teaching mathematics, this may be of concern because key concepts might be underemphasized and course outcomes goals might not be attained.

Another major concern offered by Burgan (2000) is the lack of access to modern technology for students of color and low-socioeconomic students. With the possibility of lack of technology as a hindrance for many of these students, they may be unable to fully take advantage of the opportunity of enrolling in a hybrid-format course. Furthermore, these students may have less flexibility in where they can do assigned work that is online. This may leave them with limited locations to complete assignments such as their institution where technology is available to them.

The ways in which students regulate their motivation, needs, and goals while taking a Web-based mathematics course may be a hindrance to the experience that they have online or even in a hybrid course (Xu et al, 2008). Some factors that may contribute to how well students self-regulate are their overall attitude, effort put forth to complete tasks, and willingness to take responsibility for their learning. Tallent-Runnels et al (2006) state that "anecdotal research indicates that the most successful online students are highly self-regulated learners who require little in the way of formal lesson design" (p. 109). Brown and Liedholm (2002) reported results on a comparative study among students taking traditional, hybrid, and online courses. Students taking the traditional course spent about 3 hours a week on the course. Students taking online or hybrid courses spent less time than that amount of time on the course per week. If students are reluctant to work independently when taking a college algebra hybrid course, they might not fully benefit from what this course format can offer them.

An additional concern in taking courses in the hybrid-format is that students may not be as familiar with this format when registering for courses. Clarification of course expectations are still necessary even when a course description is provided. Moreover, some students may wind up taking a hybrid course because the traditional-format course they prefer may not be available or conflicts with their schedule. In this case, more detailed education needs to take place for students where they are completely informed with requirements before taking a hybrid-format course.

The Balance Challenge

If the hybrid-format is such a great option for students, then what could be potential problems for instructors when teaching a college algebra course? Here are some challenges to consider. For an instructor, some issues that could arise may be managing the multiple intelligences (Gardner, 1983) or the different types of learners that are in a mathematics course. In a course such as this, there is a considerable amount of material to be covered with reduced face time and students frequently need more time to engage in the course content. Instructors also need immediate feedback on whether to move on or stay on topic. Furthermore, a mathematics classroom environment depends heavily on students communicating what they know and what they do not know to instructors and to their peers. Instructors also need to ensure that students are awake and that their participation is activated so that they can follow along with the lecture. Finally, instructors must ensure that students are learning the material. In light of all of these concerns,

there is delicate balance and a challenge that must be met in getting students the tools they need. Instructors have to cover appropriate material, while making sure students are learning and engaged, and getting a different experience than a traditionally taught mathematics course.

Tools for Learning in a College Algebra Hybrid Course

While a number of tools have been used in hybrid courses, the authors' believe that students are more engaged and get more out of the course when there is a combination of these three tools: student response systems or clickers (click), video lecture capture (view), and student engagement activities (action).

Student Response Systems (Click). Student response systems known as clickers (Martyn, 2007) are handheld devices that are used to enhance the learning environment for students. In a hybrid course, they are also useful because they can give instructors immediate feedback on how students are grasping concepts. Students may obtain a clicker device by purchasing it themselves or by getting a loaner device from an instructor during class. An individual code is assigned to each student, whether the device is individually purchased or borrowed, and instructors can keep track of their performance. Some of the benefits of using student response systems are that it can be used to take attendance, ensure lecture comprehension, review and reinforce key concepts, and can be used as a way of communicating with students who may be reluctant to participate verbally in class.

Attendance – Clickers can be used by instructors to manage attendance, rather than passing a student roll throughout the class or calling on every student. When prompted, students can just click a button on the device indicating that they are present and the information is digitally transmitted to the instructors' records. This is ideal typically when working with large class sizes.

Lecture Comprehension – Another way that student response systems can be used in hybrid courses is for quick conceptual check-ins. This can be a possible solution to ensure that students are following along during lectures. If students are asked to actively participate and provide their response to questions periodically throughout a lecture, they may be reluctant to get off-task with the content and may follow along more readily.

Review and Reinforcement – Because seat time is reduced in hybrid courses, it is imperative that instructors and student maximize the time that is spent together in class. Clickers can be used to review and reinforce key concepts. For example, if assigned work is given in college algebra prior to attending class, student response systems can be used to see if students have reviewed the material. It can also be used to emphasize concepts that students may be expected to know at a later date. Many clicker devices have a polling feature, which allows students to select response options, from an instructor generated multiple-choice list. The class can see the number of students that select each response option. So if many students select an incorrect response, it may reveal that students have not mastered a particular concept. For example, if an instructor is reviewing a concept like, rate of change, and a large number of students are polled and get a problem wrong that they believe to be correct; this provides an opportunity to clarify any misconceptions that may exist. Furthermore, student response systems help to inform instructors and students on areas where improvements can be made in learning. Finally, the use of games with clicker devices can also provide a fun approach to review and reinforcement.

Communication – Student response systems can be used as tool for communication with students who are reluctant to participate verbally in class. In mathematics, there are stigmas attached to not knowing the correct answer or not quickly understanding material. Through the use of clickers, instructors can aid in giving voice to silent students. There are types of silent students in mathematics classes. There are students that understand the content, but are quiet when it comes to answering questions. There are also students that do not have a clue about how to answer the questions that are asked. Finally, there are students that are uneasy about guessing in front of their peers. Because of the anonymous feature the student response systems provide, these types of students can fully participate in class without the fear or concern of student critique when they do not know the correct response or select an incorrect answer. In the next section, we will discuss the benefits of video lecture capture.

Video Lecture Capture (View). Video lecture capture is any technology that allows instructors to record themselves or portions of their class digitally to make available for students to view on demand (www.educause.edu, 2008). One popular software capture technology is *Echo360*, which allows the user to generate, produce, administer, and share course content to students to view at anytime. With the use of a microphone and a camera, *Echo360* allows an instructor to record audio or video footage of course content in the classroom, at an off-campus location, in their office, or even in a private studio, which is then transformed into ready-to-play rich media and podcasts in the echo system.

While there are a number of ways that video lecture capture can be used within an institution, there are several benefits to using the technology in a college algebra hybrid course. Three major benefits are that video capture technology provides a personalized feature to online instruction; it allows students the opportunity to revisit course content missed; and it also allows instructors an opportunity to provide greater depth to instructional content beyond what the class time permits.

Personalized Feature to Online Instruction – Video capture can help to remove the stigmatization of the online component of a course as not personalized. Video lecture capture provides a personal touch to a hybrid course for students who want to see their instructors virtually, when they are not in class. If students are viewing an actual mathematics lecture, they can gain some aspect of the experience as though they were there through the video capture. Further, if an instructor creates content on a specific topic, they have the option of displaying an image of themselves working through the material as though they were speaking directly to their students.

Students Revisit Content – There are cases where students may have missed class or may be unsure of specific topics covered. In college algebra, video capture gives students the flexibility to review or revisit this material so that they can re-examine tedious calculations or complex definitions that they still might be questioning. Students are also able to perform computations alongside the video capture to make sure that they can do the work. While video capture is not a replacement for being in a class session, it provides students with a viable option when they are unable to attend.

Greater Depth of Content – There are times when an instructor needs to go into greater detail about problems that they have initiated discussion about in class. For example, there may be a mathematics problem that is explored in class and the instructor runs out of time and cannot cover all of the important components of the problem. Using video capture, the instructor is still able to explore the problem. Offering multiple solutions or any additional supplemental information

provides students with greater depth about the problem or a broader topic. Instructors can also use video lecture capture to do content review sessions for exams, examine common errors made by students on homework or quiz assignments, point out key concepts that students should be familiar with in course material, and use the video content as a basis for engaging students in rich dialog in a course blog or in a threaded discussion on the Web.

Student Engagement Activities (Action). In order to best utilize the time spent in a college algebra hybrid course, the authors' believe that student engagement activities can help students obtain mastery of the content when they work collaboratively in small groups. Collaborative group work usually consists of a few students working together on the same task (Edwards & Jones, 2003). Edwards and Jones (2003) also point out that, "within a collaborative group, decisions are shared and the negotiation of roles and relationships constantly evolves" (p. 135). The collaborative group model is strongly linked to social constructivism; a theory of learning that is related to situated cognition (Lave, 1988), and scaffolding or zone of proximal development (Hmelo-Silver et al, 2007; Vygotsky, 1978).

In a hybrid course where and instructor can move through information fairly quickly, the authors' emphasize the use of collaborative groups. Instructors can engage students in debate, discussion, and when necessary, use scaffolding as a teaching strategy for difficult mathematical concepts. This process can help students become independent problem-solvers (Hartman, 2002). When carefully planned group tasks are given to students, it helps them to think critically about the mathematics while they are constructing their own meaning (Lave, 1988). According to Vygotsky (1978) learning takes place when the view that students have of their knowledge is challenged, improved, and refined through engagement with others. In many cases, students tend to do mathematics in isolation. We encourage students to work collectively to discuss possibilities for their answers. For example, instructors can pose open-ended questions to students in collaborative groups upon entering the classroom and provide them with time for discussion among members. The class can then come back together to unpack key concepts. This recommendation is consistent with McIssac et al (1999) who report that *interaction* is "the single most important activity in a well-designed distance education experience" (p. 122).

Best Practices in Hybrid-Format Courses

In order to enhance student experience with hybrid-format courses, some educators have suggested some best practices. It is important to note that some of these strategies have been applied to courses taught completely online, but could be easily transferred to hybrid-formats.

Montera-Gutiérrez (2006) conducted a study to examine the best and worst practices of faculty teaching blended learning in online and face-to-face instruction. His findings were divided into three categories: (a) instructional conditions, (b) instructional methods, and (c) instructional results. Some of the best practices he identified for instructional conditions included faculty that were flexible in changing course learning objectives when necessary; establishing direct social contact with students early in the course to administer any pertinent information that may be useful; and creating well-defined assignments to be completed by students at the end of a unit or module. For instructional method, he found that faculty that scheduled orientation and tutorial sessions and that developed visual and audio teaching materials increased student understanding. Finally, for instructional results instructors that organized every learning outcome throughout the semester helped to accomplish their learning objectives. Instructors that were flexible when

administering student assignments and that were quickly responsive when giving feedback to students motivated student performance.

Some of Montera-Gutiérrez's (2006) findings are consistent with educators that have found that students prefer flexibility. There are a number of studies that have reported that students prefer setting their own pace when taking an online course. Pacing has been identified as one of the most important motivations for students choosing online instruction (Richards & Ridley, 1997; Roblyer, 1999; Wilson & Whitelock, 1998). As Tallent-Runnels et al (2006) state, "students like the opportunity to choose both when and where to learn" (p. 111). The implications for best practices in a college algebra hybrid course are to find a mix of course deliverables that students can complete over time with those that have strict deadlines. Some examples are, out of class assignments that have an extended deadline or a course project with components due throughout the semester. Students can submit portions of the project for feedback to ensure that they are on the right track.

Another best practice strategy when teaching online has been to incorporate problem-based learning (PBL) into instruction. PBL is a student-centered pedagogical strategy where students learn about content situated in a real-life problem (Amador et al, 2006). Trinidad and Pearson (2004) conducted an Online Learning Environments Survey (OLES) to determine the effectiveness of PBL in online courses. Findings from this study showed that students' real and ideal scores were linked. The study also concluded that PBL provides a useful approach for teaching online and suggests educators use it as a tool to enhance this environment. This finding is consistent with our view about incorporating student engagement activities in the college algebra hybrid course. Activities that help students make decisions and develop conceptual understanding of mathematics content would be appropriate here.

How Effective Is Hybrid Courses at the Authors' Institution?

The authors have begun collecting data for a longitudinal study of hybrid courses taught across different disciplines at their institution. The overarching goal of the study is to evaluate attitudes and effectiveness of hybrid courses. This investigation will assess student and faculty attitudes about the course, student preferences for learning modes (online versus face-to-face), as well as student achievement of learning outcomes in both traditional and hybrid versions of the course. The goal of the study is to improve upon the design and development of hybrid courses in the future.

For mathematics, the authors' questions concern the effectiveness of college algebra hybrid in comparison to the traditionally college algebra taught course. Furthermore, we are interested in knowing if there are any differences in attitudes of students taking college algebra hybrid and students taking the traditional course.

CONCLUSION

Studying hybrid courses is a fruitful area of research. In particular, investigating many facets of the college algebra hybrid course is an area of research that has not been explored extensively. Implications for further research lie in creating new models for hybrid instruction in mathematics that will produce the most effective outcome in teaching and in helping students optimize their learning. Further research should be conducted to explore how students construct mathematics knowledge within this type of learning environment as compared to a traditional mathematics course.

REFERENCES

Amador, J. A., Miles, L., & Peters, C. B. (2006). *The practice of problem-based learning: A guide to implementing PBL in the college classroom.* San Francisco: Jossey Bass.

Bonk, C. J., Kim, K. J., & Zeng, T. (2006). Future directions of blended learning in higher education and workplace learning settings. In E. O. Baek (Ed.), *The Handbook of Blended Learning: Global Perspectives, Local Designs* (pp. 550-567). San Francisco, CA: Pfeiffer.

Brown, B. W., & Liedholm, C. E. (2002). Can Web courses replace the classroom in principles of microeconomics? *American Economic Review, 92*(2), 1-12.

Burgan, M. (2000). Testimony before the Web-based Education Commission. Retrieved May 12, 2011 from http://www.aaup.org/ Issues/DistanceEd/719wbtst.htm

Driver, M. (2002). Investigating the benefits of Web-centric instruction for student learning: An exploratory study of an MBA course. *Journal of Education for Business, 77*(4), 236-245.

Dutton, J., Dutton, M., & Perry, J. (2001). Do online students perform as well as lecture students. *Journal of Engineering Education, 90*(1), 131-141.

Educational Encyclopedia. (2011). Nontraditional students in higher education – Types of non-traditional students in the United States, support for nontraditional learners. Retrieved May 27, 2011 from http://education.stateuniversity.com/pages/2298/Nontraditional-Students-in-Higher-Education.html

Edwards, J. and Jones, K. (2003). Co-learning in the collaborative mathematics classroom. In, Peter-Koop, A., Begg, A., Breen, C. and Santos-Wagner, V. (Eds.) *Collaboration in Teacher Education: Examples From the Context of Mathematics Education.* Dordrecht, The Netherlands, Kluwer, 135-151.

Educause. (December, 2008). 7 things you should know about lecture capture. Retrieved May 24, 2011 from http://www.educause.edu/ELI/7ThingsYouShouldKnowAboutLectu/163555

Faux, T. L., & Black-Huges, C. (2003). A comparison of using the Internet versus lectures to teach social work history. *Research on Social Work Practice, 10*(4), 454-466.

Gardner, H. (1983). *Frames of mind: The theory of multiple intelligences*. New York: Basic Books.

Garnham, C., & Karleta, R. (March 20, 2002). Introduction to hybrid courses. *Teaching with Technology Today, 8*(6*)*. University of Wisconsin-Milwaukee. Retrieved May 1, 2011 from http://www.uwsa.edu/ttt/articles/garnham.htm

Hartman, H. (2002). Scaffolding & Cooperative Learning. *Human Learning and Instruction* (pp. 23-69). New York: City College of City University of New York.

Hmelo-Silver, C. E., Duncan, R. G., & Chinn, C. A. (2007). Scaffolding and achievement in problem-based and inquiry learning: A response to Kirschner, Sweller, and Clark 2006.

Educational Psychologist, *42*(2), 99–107.

Kerres, M., & DeWitt, C. (2003). A didactical framework for the design of blended learning arrangements. *Journal of Educational Media, 28,* 101-114.

Lave, J. (1988). *Cognition in practice: Mind, mathematics, and culture in everyday life*. Cambridge, UK: Cambridge University Press.

Maki, W. S., & Maki, R. H. (2001). Mastery quizzes on the Web: Results from Web-based introductory psychology course. *Behavior Research Methods, Instruments, & Computers, 33,* 212-216.

Martyn, M. (2007). Clickers in the classroom: An active learning approach. *EDUCAUSE Quarterly (EQ), 30*(2).

McIssac, M. S., Blocher, J. M., Mahes, V., & Vrasidas, C. (1999). Student and teacher perception of interaction in online computer-mediated communication. *Educational Media International, 36,* 121-131.

Montera-Gutiérrez, F. (2006). Faculty best practices using blended learning in e-learning and face-to-face instruction. *International Journal on E-Learning, 5*(3), 313-337.

Nontraditional students in higher education - Types of nontraditional students in the United States, support for nontraditional learners. Retrieved May 18, 2011 from http://education.stateuniversity.com/pages/2298/Nontraditional-Students-in-Higher Education.html#ixzz1MjLkPFzh

Osguthorpe, R. T., & Graham, C. R. (2003). Blended learning environments: Definitions and directions. *The Quarterly Review of Distance Education, 4*(3), 227-233.

Picciano, A. G. (2006). Blended learning: Implications for Growth and Access. *Journal of Asynchronous Learning Networks, 10*(3), 95-102.

Richards, C. N., & Ridley, D. R. (1997). Factors affecting college students' persistence in on-line computer-managed instruction. *College Student Journal,* 490-495.

Roblyer, M. D. (1999). Is choice important in distance learning? A study of student motives for taking Internet-based course at the high school and community college levels. *Journal of Research on Computing in Education, 32*(1), 157.

Sands, P. (March 20, 2002). Inside outside, upside downside: Strategies for connecting online and face-to-face instruction in hybrid courses. *Teaching with Technology Today, 8*(6). University of Wisconsin-Milwaukee. Retrieved May 20, 2011 from http://www.uwsa.edu/ttt/articles/sands2.htm

Singh, P., & Pan, W. (2004). Online education: Lessons for administrators and instructors. *College Student Journal*, *38*(2), 302-8.

Tallent-Runnels, M. K., Thomas, J. A., Lan, W. Y., Cooper, S., Ahern, T. C., Shaw, S. M., & Liu, X. (2006). Teaching courses online: A review of the research. *Review of Educational Research, 76*(1), 93-135.

Thirunarayanan, M.O., &Perez-Prado, A. (2001/2002). Com- paring Web-based and classroom-based learning. *Journal of Research on Computing in Education, 34*(2), 131-137.

Trinidad, S., & Pearson, J. (2004). *Implementing and evaluating e-learning environments*. Paper presented at Beyond the Comfort Zone: Proceedings of the 21st ASCILITE Conference, Perth, Australia.

Vygotsky L.S. (1978). *Mind in society: The development of higher mental processes*. Cambridge, MA: Harvard University Press.

Ward, B. (2004). The best of both worlds: A hybrid statistics course. *Journal of Statistics Education, 12*(3). Retrieved May 18, 2011 from www.amstat.org/publications/jse/v12n3/ward.html

Wilson, T., & Whitelock, D. (1998). Monitoring the on-line behavour of distance learning students. *Journal of Computer Assisted Learning, 14,* 91-99.

Xu, Y. J., Meyer, K. A., & Morgan, D. (2008, July). Piloting a blended approach to teaching statistics in a college of education: Lessons learned, *The Journal of Educators Online*, *5*(2).

Young, J. R. (2002, March 22). Hybrid teaching seeks to end the divide between traditional and online instruction. *The Chronicle of Higher Education*, p. A33.