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# A Comparison of Delivery Methods for Distance Learning Mathematics Courses

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## **ABSTRACT:**

In order to address the diverse needs of today's students, various forms of course delivery methods are required to accommodate students' learning needs. In the Learning Support Mathematics courses at Columbus State University, we have implemented different course design delivery methods that incorporate distance learning models. The implementation of this study has enabled us to collect data and evidence about the effectiveness of varied distance learning delivery method for curriculum development purposes through the use of grades, teacher observations and a comparison of students' performance in core mathematics courses and mathematical related major courses. These implementations have also met the needs of our active and retired military that heavily populate this area. A comparison will be made of the techniques, experiences, applications and data that are being utilized in the different formats. Topics discussed will include logistics, online resources, and form of assessments, curriculum development, and indications of a review of the results.

## **INTRODUCTION:**

In order to successfully meet students' goals in life, colleges and universities need advanced preparation of mathematics in the curriculum. Developmental courses are offered by many colleges in order to prepare these students for higher-level courses. However, most teaching strategies traditionally used by most college professors have produced low passing rates in these courses. Colleges and universities are trying alternative instructional approaches to improve the teaching of developmental mathematics with the goal of increasing the number of students who have the skills and knowledge required for college-level math courses and for the twenty-first century workforce. This study will examine whether there are differences in the academic achievement of students enrolled in a developmental mathematics course using traditional instruction, supplemented with computer-assisted instruction, or an online distance learning course.

At Columbus State University, Developmental Math courses are offered in three delivery methods: the traditional face-to-face (FTF) classroom, hybrid format and fully online format. In FTF class, the instructor implements traditional teaching methods, and students are not required complete online work. Students can ask questions while being taught, and the instructor confirms that students understand the concepts before moving forward. However, students have to face numerous challenges like the need to follow class schedule, learning together at the pace of the whole class, and being physically present in the classroom, for this learning method.

Hybrid (2<sup>1</sup>) courses offer students more flexibility because they reduce the amount of time that students need to be on campus. One advantage of this format is that it provides more available classroom space. For students who work full-time, this saves time and makes scheduling events in their lives much easier. Students do not have to find parking spaces, leave

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<sup>1</sup> See References

work early to go to class, or miss family time. It is recommended that students try to develop a study routine if possible. Students are able to plan their study time around the rest of their day instead of around class time. Whether to study at night or in the morning is up to the student. Having to work and attend classes at the same time can be very stressful and online classes remove this stress by allowing students to learn when it is convenient for them. Hybrid courses offer students more flexibility. For the instructor of hybrid classes, the integration of out-of-class activities with the in class activities allows for more effective use of traditional class time. Challenges for instructors include learning new course technologies, aiding students in learning, and trouble-shooting new course technologies. At Columbus State University, the Learning Management System (LMS) is D2L (Desire2Learn). The access to D2L is on CSU's web homepage. Students access D2L for the course schedule, daily news item, weekly discussion board, learning materials, and assignments. In order for students to be successful in online (1<sup>2</sup>) and hybrid classes, in addition to having high-speed internet service, it requires computer and technical skills, self-motivation, access of web assign, and the ability to complete assignments in a timely manner.

Hybrid and online courses require students to be fairly competent with technology. While some students can navigate web-based programs with ease, other students and non-traditional students may become frustrated, which can impede their learning. This causes the student to fall behind in their assignments or, in some cases, to withdraw from the course.

## **REVIEW OF THE LITERATURE:**

In the last decade, distance education has been accepted into mainstream education. Research indicates that the learning environment does indeed have an effect on developmental students' completion rates (Zavarella, & Ignash, 2009). Universities such as Columbia, Stanford, the London School of Economics, and the University of Virginia (Eggen, 2000) suggest that 54,000 courses enrolled 1.6 million students in distance education programs in 1998 (National Center for Educational Statistics, NCES, 1999; Merisotis, 1999), and were expected to exceed 2 million by the year 2002 (Stewart, 2001). According to U.S. Department of Education's IPEDs data, 5.5 million students took at least one online course in 2012. Between 1994 and 1998, the proportion of colleges and universities offering online distance education rose from about 11 to 44% (NCES Fast Facts, 2001).

According to two well-respected researchers and practitioners in developmental education, there always have been and always will be college students who are academically weak and poorly prepared but very capable of succeeding with additional assistance (Casazza, 1999; Maxwell, 1979). The demand from the Nontraditional students is the simply the reason for this trend. Distance education has experienced some growing pains and is not for everyone. Most of the success stories come from those who are more disciplined and able to follow a schedule on their own. Kathleen Burke stated that undoubtedly, distance education, in its various forms, opens opportunities to many, especially to women with children and military personnel who are moved often (Brown, 1999). Distance education offers learners the

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<sup>2</sup> See references

convenience and flexibility to learn at anytime, anywhere. Access to instruction is available around the clock for those who want including those who cannot travel long distances, it also opens the door for knowledge (Owston, 1997).

Some reports have been published with encouraging results that student dropout rates can be decreased using online education (Carnevale, 2000) while others (Johnstone & Krauth, 1996) mention no significant learning outcome differences in distance education compared to traditional classroom methods (Russell, 2001; Young, 2000). Different delivery methods were studied by Li, and Amin, found that the withdrawal rate (W) for online courses were to the highest. One reason may be that these students may feel less connected to the class as compared to face-to-face students. Connecting these students to other's in the class can help the retention rate because this provides these students with a support network. (Li, Uvah, Amin, & Hemasinha, 2009) There is a 93-page report prepared for the United States (US) Department of Education studying US online education examines the comparative research on online versus traditional classroom teaching from 1996 to 2008. The document states that online learning is one of the fastest growing trends in education. The pooled analysis found better learning results from a blend of online and face-to-face instruction. There are many studies indicates no significant difference in success based on learning environment (Neuhauser(2002) Sauers & Walker(2004),Scheez & Guntner (2004) A recent *Community College Research Center (CCRC)* study finds that while all community college students show a decrement in performance in fully online courses, some students show a steeper decline than others, including males, students with lower prior GPAs (Xu & Jaggars, 2013). Boylan asserted "Computer-based distance learning has yet to be proven effective with developmental students. Distance learning often requires independent learning skills, study discipline, time management skills, and a high degree of motivation, which may not suite all the students" (2002).

Traditional instruction is teacher-centered and characterized by direct instruction. Direct instruction usually includes the presentation of material, thinking aloud by the teacher, guided practice, correction and feedback, and modeling by the teacher (Kinney and Robertson, 2003). The teacher plays the role of the expert imparting knowledge. The teacher decides what, when, and how students should learn (Brown, 2003; Kinney and Robertson, 2003). All students study the same topic at the same time.

Computers and the Internet make possible new methods of delivering instruction to developmental mathematics students so that they will have choices about when, where, and how they learn mathematics. Computer-assisted instruction, according to some researchers, has great potential for developmental education because it allows a student to work at his or her own pace, provides immediate feedback, guided practice problems, and 24-hour access (Kinney, 2001; MacDonald et al., 2002; Merisotis and Phipps, 2000; Miles 2000).

## **METHODS:**

In the Learning Support Mathematics at the Columbus State University (CSU), we (Hassani, Casleton and Shukla) have implemented different course design delivery methods that incorporate distance-learning models. At the CSU, we teach Developmental math 1& 2 and Preparatory Algebra. Students who achieves success in Developmental math 1&2 (60% or

higher) is eligible to take Compass posttest, and success rate in preparatory Algebra (70% or higher) means that a student have the necessary pre-requisite knowledge to register for core college-level math courses. The material covered in these courses includes real numbers, exponents and radicals, linear and quadratic equation and inequalities, factoring, functions, rational expressions, coordinate geometry, and graphing first and second-degree functions.

Since the learning environment was the variable being measured in this study, every effort was made to ensure that the classes in each environment were the same, except for the medium used to communicate and complete assignments. We, the authors of this paper taught one or two sections in each of the learning environments. We worked to create the online materials. The methods for approaching problems provided online were the same methods used in all the learning environments. All three methods used the same syllabus, course content, and all unit tests were drawn from the same set of topics and questions and all tests were timed. Homework and quizzes were implemented in the hybrid and fully online classes, while traditional paper and pencil tests were provided for the face-to-face classes. A description of each learning methods follows:

#### Face-to –Face learning Method

In Face-to-Face learning method, the class met for three and half hours (either two or three days of class) a week. No online materials were provided to these students and no part of their grade required the use of online technology. We provided help outside of class through emails, office hours, and phone calls to those students that needed extra assistance. The instructors taught using the same procedures, instructions, and examples in all of their face-to-face classes. This method involved tests, quizzes, homework, and class involvement.

#### Hybrid learning Method

Hybrid class structure at the CSU reduces 33% class time for the students. Students in the Hybrid learning class had access to all course materials online as well as in weekly face-to-face class meetings. When registering for the course, all the information about date, days, and times is listed. On the first day of class, the students were informed about the reduce time and what expected of them to do online. This method included tests, quizzes, homework assignments, and discussion board. Student completed homework and quizzes online. Tests were administrated in classroom. Lectures were given to the same format as FTF.

#### Online Learning method.

Those students that choose to enroll in the online learning course must take the Smarter Measure Assessment Survey, which indicate test their efficiency in computer skills. Students enrolled in the online learning course accessed all materials through the course management software (WebAssign), never actually met face-to-face. Each unit was arranged with all its materials listing all the objectives, the unit quiz, and the unit test personal study plans and other resourses. Each objective had several learning activities to assist students: a lecture, video, a handout, and practice problems and answers. There were practice tests for the entire units that students could take. This method involved tests, quizzes, homework, and discussion boards. These course format benefits students who live in remote locations or at a

distance. At our campus, we serve large military base population.

## **RESULTS:**

The success rate of students who enrolled in developmental Math 1 for Face to face method was 88.6% compared to the online, which was 77.5% and the Hybrid, which was 80%. The success rate in developmental Math 2 for the face-to-face method was 92% while the rates for Hybrid and Online were 82.5% and 88% respectively. In Preparatory Algebra, the success rate for face to face was 90%; the success rate for Hybrid was 92%; the success rate for Online was 72%. Overall, according to the data, it can be concluded that the face-to-face method is more effective compared to hybrid and online methods as it has a success rate in all math. Based on our department Hybrid math course success rate, student who participate in these classes have lower success rates than the traditional FTF courses. Overall, online math classes in our department have much lower success rates than FTF or hybrid learning method.

### **Success Rate for Remedial Math Courses- 2013**

	Face to Face	Hybrid	Online
Developmental Math 1	88.6%	80%	77.5%
Developmental math 2	92%	82.5%	88%
Preparatory Algebra	90%	92%	72%

This data, however, is based solely on a one-year study in our department. We recommend doing larger study for longer duration, which may study desired effects with better accuracy.

## **CONCLUSION:**

National research studies show method of delivery is not significant for the success rate. However, the nontraditional student population generally performs at a lower passing rate than the traditional college student. We think the reason behind this observation is lack of exposure for new technology systems among adults. Based on our limited data at our institution, we observed successful pass rate in the FTF on more occasions than the other formats, but further study is required to demonstrate which medium is more effective.

In future we are planning to explore the performance of our students in required core math classes and identify their retention and graduation rates.

## REFERENCES:

- (1) 10 Advantages to Taking Online Classes, Online Education Database - Online Colleges and Universities, website: <http://oedb.org/library/distance-vs-local/10-advantages-to-taking-online-classes>
- (2) Advantages and Challenges for Hybrid Courses, Columbus State Community Collegewebsite: <http://global.csc.edu/GettingStarted/advchal.asp?T=H>
- (3) Boylan, H.R. (2002). *What works: Research-based best practices in developmental education*. Boone, NC: Continuous Quality Improvement Network with the National Center for Developmental Education.
- (4) Brown, K. L. (2003). From teacher-centered to learner-centered curriculum: Improving learning in diverse classrooms. *Education*, 124(1), 49-54.
- (5) Brown, J. (October , 1999). Distance learning for full-time lives. *Converge*, 26, 28.
- (6) Carnevale, D. (2000, January). Online instructor takes step to reduce dropout rate. *The Chronicle of Higher Education*, p A48. Retrieved on June 1, 2006 from: <http://chronicle.com/infotech/>
- (7) Casazza, M. (1999) Who are we and where did we come from? *Journal of Developmental Education*, 23(1), 2-6.
- (8) Community College Research Center <http://ccrc.tc.columbia.edu/Community-College-FAQs.html>
- (9) Eggen, D. (April 7, 2000). Logging on to college. *Washington Post*, p. B1.
- (10) Johnstone, Sally & Barbara Krauth (1996) Balancing equity and access: Some principles of good practice for the virtual university *change* 28(2): 38-41.
- (11) Kinney, D. P., & Robertson, D. F. (2003, Fall). Technology makes possible new models for delivering developmental mathematics instruction. *Mathematics and Computer Education*, 37(3), 315-328.
- (12) Kinney, D. P. (2001, Winter). Developmental theory: Application in a developmental mathematics program. *Journal of Developmental Education*, 25(2), 10-18, 33-34.
- (13) Li, K., Uvah, J., Amin, R. & Hemasinha, R., *A Study of Non-traditional Instruction on Qualitative Reasoning and Problem Solving in General Studies Mathematics Courses*, *Journal of*

Mathematical Sciences and Mathematical Education, Vol., 4 No. 1 2009, pp. 37-49.

(14) MacDonald, L., Vasquez, S., & Caverly, D.C. (2002, Winter). Techtalk: Effective technology use in developmental mathematics. *Journal of Developmental Education*, 26(2), 35-37.

(15) Maxwell, M. (1979). *Improving student learning skills: A comprehensive guide to successful practices and programs for increasing the performance of underprepared students*. San Francisco: Jossey-Bass.

(16) Merisotis, J. P., & Phipps, R. A. (1999). What's the difference? A review of contemporary research on the effectiveness of distance learning in higher education. Washington, DC: The Institute for Higher Education Policy.

(17) Miles, C. (2000, Spring). Developmental mathematics traditions and alternatives: An interview with Bob Hackworth. *Journal of Developmental Education*, 23(3), 20-23.

(18) National Center for Educational Statistics Fast Facts. (2001) U.S. Department of Education. Retrieved November 10, 2001, from <http://nces.ed.gov/fastfacts/display.asp?id=8>

(19) National Center for Educational Statistics, U. S. Department of Education. (1999).

(20) Neuhauser, C. (2002). Learning style and effectiveness of online and face-to-face instruction. *The American Journal of Distance Education*, 16(2), 99-113

(21) Sauers, D., & Walker, R. C. (2004). A comparison of traditional and technology-assisted instructional methods in the business communication classroom. *Business Communication Quarterly*, 67(4), 430-442.

(22) Scheetz, N. A., & Guntner, P. L. (2004). Online versus traditional classroom delivery of a course in manual communication. *Council for Exceptional Children*, 71(1), 109-120. Waycaster, P. (2001).

(23) Stewart, E. M. (2001). Higher education online. Retrieved October 20, 2001 from <http://wind.winona.msus.edu/%7Ebjpg/papers/EileenStewartcsfinpaper.htm>.

(24) Russell, T. L. (Ed.). (2001). *The no significant difference phenomenon*. Raleigh, NC: North Carolina State University. Retrieved November 20, 2008, from [www.nosignificantdifference.org](http://www.nosignificantdifference.org)

(25) Young, J. R. (2000, February 10). Scholar concludes that distance ed is as effective as traditional instruction. *Chronicle of Higher Education*. Retrieved October 14, 2001 from <http://chronicle.com/free/2000/02/1001u.htm>

(26) Zavarella, C. & Ignash, J. (2009). Instructional delivery in developmental mathematics:

Impart on retention. *Journal of Developmental Education*, 32 (3).