Running head: CORD CURRICULUM FOR REMEDIAL MATHEMATICS

CORD Curriculum for Remedial Mathematics

Ashley Keller

American Intercontinental University Online

Abstract

As the educational level of our high school graduates diminishes the colleges and universities are being forced to pick of the slack and more undergraduates than ever before are being required to enroll in to remedial mathematics courses. With the success rate of these remedial classes being less than ideal the Center for Occupational Research and Development has constructed a new curriculum approach for these classes focused on hands-on learning and real-life applications.

CORD Curriculum for Remedial Mathematics

Introduction

As the rate of freshmen college students enrolling in remedial math courses increase it is essential to address the best instructional process for these students. Senior Vice President of the Southern Regional Education Board, Gene Bottoms said it best, “it’s sinful to allow a student to show up at a community college and tell them they’ll have to spend the year learning what they should have learned in high school” (Spencer, 2004, p. 1). The Center for Occupational Research and Development (CORD) has put together and began implementing a new approach at instruction for these college level remedial mathematics students.

Background on Case Study

USA Today reports that nearly one million high school students are taking advanced placement courses in high school while nearly 53% of college freshman are also enrolling into remedial math and English courses (US Today, 2004, p. 12). To research and understand more effective ways to teach, instruct or guide college students in remedial mathematics curriculum can lead to greater confidence and success by students and teachers. Sonja Graves case study entitled *Success in Postsecondary Development Mathematics* was designed to evaluate the effectiveness of using the CORD methodology of teaching remedial mathematics at the college level. CORD developed a split curriculum for remedial mathematics, focusing independently on both the fundamentals of mathematics and Algebra instruction, this curriculum is known as the *Mathematics Foundations for Introductory College Mathematics.*

Setting & Social Situation

The evaluation of 571 college students and fifteen instructors “…in eleven community colleges and one technical college in the states of Florida, Illinois, Maine, New York and Texas”

(Graves, 1998, p. 2). Of the students involved in the study 89% were required to take the remedial mathematics class due to failing their college entrance exams and provided qualitative reasons like “because I’m horrible in math,” “because they tell me I have to,” or because “I feel I hardly know the world of mathematics” (p. 13). Within each school the CORD curriculum was tested in a random sampling of students required to take remedial math were selected to participate in the study in hopes of creating the most unbiased process as possible.

The CORD curriculum was specifically designed to assist in the transfer of mathematics knowledge to daily use in the workforce by utilizing hands-on and real life examples in the classroom. Due to the curriculums diverse approach at instructional guidance the instructors were required to attend a professional development workshop in which they became familiar with philosophies around hands-on learning and actually took part in similar projects as would be implemented within their classrooms (Graves, 1998, p. 6). In the end 64% of the instructors agreed that the professional development instructional time contributed to the success of the course and implementation techniques utilized (p. 18).

Curriculum Evaluation Model

Evaluations of CORD curriculum and instructional effectiveness was approached from four different angles, a quantitative and qualitative analysis of instructors and a quantitative and qualitative analysis of students. Graves analyzes each of the evaluations factors that Kirkpatrick and Hawk identify within their four level evaluation theory: reaction, learning, behavior, and results (2006, p. 61). Reaction of students and teachers, along with behavior aspects are approaching in their pre- and post- qualitative surveys. Learning and results analysis are primarily addressed within the quantities studies provided to both students and instructors.

As addressed in *Kirkpatrick's four-level-model for assessing training effectiveness* (UniServe Connections, 2006, chap. 1), the reaction level of Kirkpatrick's model addresses how both students and instructors react to the curriculum. This reaction level addresses a key point, if teachers are less motivated to instruct their student, the students are less likely to be successful within the course itself. If students' reactions are initially poor to the curriculum, it is likely they will not be successful in their endeavors either, and adaptations to the curriculum need to be made or different approaches at instruction should be utilized. Level two, as defined in Kirkpatrick's Evaluation Model, is learning (chap. 1). Learning the key to all education, it requires an increase in understanding, comprehension or skill. Next is behavior, this level provides and internal view at how students and teachers behaviors have changed as a result of the new curriculum, new beliefs which have been form or confidences that were attained (chap. 1). The final evaluation factor is level four, results (chap. 1). The results level is an overarching idea that requires feedback not only on performance results but positive and negative behavioral changes or reactions to the curriculum as well.

Assessment Tools

CORD selected and utilized four partitions of analysis and evaluation within their assessment. These assessment tools were a combination of pre- and postsurveys and pre- and posttests, along with instructor and students reactions and attitudes discovered through interviews. "…Riordan & Noyce (2001) assessed reform's impact by comparing students' scores on standardized achievement tests. Other researchers have used structured interviews… (e.g., Boaler, 1997)" (Star & Hoffmann, 2002, p. 1729). As one can see these are not uncommon methods to be used in mathematics reform assessments. Although not specifically stated by Graves, it is assumed that all surveys and tests were completed within the classroom

environment. For the pre- and posttests students were asked to complete as many questions as possible. In regards to the surveys, students and teachers were asked to describe their experiences and attitudes pre- and postclass following the Conceptions of Mathematics Inventory presented by Grouws (1994). Each student, or student and teacher, respectively, completed the tests and surveys twice, once that the start of the semester and once at the end. Finally, concluding interviews were conducted via e-mail or telephone to assess the instructors' experiences. The assessment tools utilized, surveys, tests and interviews, were appropriate for the audience at hand and successfully presented significant results on the CORD present curriculum.

Evaluation Outcomes & Recommendations

The evaluation by CORD produced significant results in favor of their new curriculum and instructional process. The success of students on posttest over their pretest scores showed a 26.2% increase in academic performance regarding fundamental mathematics (Graves, 1998, p. 9). When assessed individually, Algebra performance by students produced and 89.6% increase in performance (p. 10). Students expressed a significantly positive experience and believed the hands-on applications utilized within the curriculum were an asset to their understanding (p. 12). Students expressed less frustration (p. 14) and more confidence (p. 16) in the mathematics abilities.

Instructors expressed a substantial change in opinion regarding their frustration and enjoyment of instructing their students (p. 17-18). Over half the instructors also agreed that they were pleased with the overall performance of their students (p. 19). Although the instructors did have suggestions for change within the textbook itself "62% of instructors would recommend the course to their colleagues" (p. 19).

Graves states that additional longitudinal studies need to be conducted in order to finish the validation of the above results to assure external factors were not playing a significant roll in these outcomes. She suggests a long-term academic performance analysis along with a study on the relationship between attitudinal improvement and academic success in student. In the same breath comes an assessment of the relationship between teachers' attitudes and the academic success of their students. With these revised evaluation results there will be a nearly complete view and understanding of the CORD curriculum, its instructional effectiveness and long-term academic performance. There is however one significant addition of information which needs to be considered and is blatantly ignored within the entire evaluation process, a control line. Every student in the CORD curriculum course is comparing their opinion to previous mathematics classes they were part of. None of the evaluation and assessment tools compare results against students in parallel non-CORD remedial mathematics courses. Granted a variety of instructional approaches are utilized in the parallel, non-CORD course, however such a pre- and posttest and pre- and postsurvey analysis will verify it is the CORD curriculum which leads to greater success of their students rather than the student merely needing a second *look* at the curriculum in any fashion.

Analysis of Curriculum

Extended analysis is generally always beneficial, even if only to support ones ideas and beliefs. In addition to the analyses conducted within the evaluation presented by Graves, it would be advantageous to address the topics covered within a current remedial mathematics course and the percent of that material which is covered in the same time frame in a CORD curriculum remedial mathematics course. In addition it would be wise to address different types of learners, and conduct an analysis regarding the effectiveness of CORD curriculum on students who are

visual, auditory and sensory learners. While kinesthetic learners may find CORD curriculum significantly easier to understand, auditory and visual learners may have difficult with the curriculum (Gordon, 1998, p. 17-18).

Evaluation Model

The evaluation model utilized by CORD was strong, although extensions and adaptations to their basic evaluation model could provide additional invaluable insight into the curriculum, teaching techniques used and the impact on the students. If one takes an in depth look at the results provided within the evaluation it seems quite questionable as to why one aspect of the CORD curriculum, mathematics fundamentals, was over three less beneficial to its students than the CORD Algebra curriculum. In addition the apparent wording of pre- and postsurveys on opinions and instructional interviews could have created a bias in data obtained. This is difficult to assess as the actual questionnaires were not provided. However, just as Boaler realized in her mathematic reform assessment interview and observations, a teacher may have "reported that it was important for the students to find their own ways of solving problems, but in the day-to-day realities of the classroom, they rarely allowed this to happen" (1997, p. 28). This is what is referred to as "yea-sayin" a phenomena in which survey takers or interviewees answer question in which they believe and interviewer would like them to, not in an accurate manner (Quirk's, 1982, 11 ¶). Thus not only was it essential for the interview to be conducted as CORDs evaluation did, but the addition of classroom observations in the evaluation process would verify or not verify the statements and beliefs of the instructors. In addition to this is questionnaire bias based on the phrasing of questions, for example a pretest asking if a student was frustrated in their previous mathematics courses and a posttest asking if they enjoyed their most recent

mathematics course, this would be considered a leading question (Choi & Pak, 2004,) and not a valid set for comparison.

Conclusion

The CORD curriculum is an innovative and much needed approach at mathematics within education. Analysis and evaluation claims that the curriculum has had great success in eleven different schools across the United States in which it was implemented in. Although this approach of hands-on learning bringing career orientated applications of mathematics into the classroom appears to be beneficial to its current students, additional evaluation is still necessary along with a closer look at the data already collected. It is commendable to acknowledge the growing number of remedial mathematics students entering into our colleges and universities, and to research a process to specifically assist them in their mathematics endeavors. However, in this particular case it would seem more beneficial to address the problem at the high school level so the problem never progressed into the post-secondary environment.

References

Boaler, J. (1997). *Experiencing school mathematics: Teaching styles, sex, and setting.* Buckingham: Open University Press.

Choi, B., & Pak, A. (2004). A Catalog of Biases in Questionnaires. *Preventing Chronic Disease 2,* 1. Retrieved September 15, 2007 from http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=1323316

Gordon, H. (1998). *Identifying Learning Styles.* Montgomery, WV: West Virginia University Institute of Technology. (ERIC Document Reproduction Service No. ED424287).

Graves, S. (1998). *Success in Postsecondary Developmental Mathematics: A Curriculum Evaluation.* Waco, TX: Center for Occupational Research and Development.

Grouws, D.A. (1994). *Conceptions of mathematics inventory.* Iowa City, IA: University of Iowa.

Kirkpatrick, J., & Hawk, L. (2006). Curricula and Evaluation: Maximizing Results. *T+D, 60,* p. 61.

Quirk's. (1982). *Understanding data requires recognition of types of error.* Retrieved September 15, 2007 from, http://www.quirks.com/articles/a1987/19870504.aspx?searchID=2447292&sort=9

Spencer, J. (2004). It's back to basics for many in college. [Electronic version]. *Houston Chronicle, 1-3.*

Star, J. & Hoffman, A. (2002). *Assessing Students' Conceptions of Reform Mathematics.* Columbus, OH: ERIC/CSMEE Publications. (ERIC Document Reproduction Service No. ED471777)

USA Today. (2004). High schools skip over basics in rush to college classes. [Electronic version]. *USA Today, Feb 27,* 12.

UniServe Connections. (2006). *Chapter 1: Appendix 2. Kirkpatrick's four-level model for assessing training effectiveness*. Retrieved September 15, 2007 from, the University of Sydney, UniServe Science Web site: http://science.uniserve.edu.au/projects/service_teaching/