Student Achievement in Basic College Mathematics: Its Relationship to Learning Style and Learning Method

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From the assumption that matching a student's learning style with the learning method best suited for the student, it follows that developing courses that correlate learning method with learning style would be more successful for students. Albuquerque Technical Vocational Institute (TVI) in New Mexico has attempted to provide students with more than one learning method in its Basic College Mathematics course. Three courses were developed to correlate curriculum with learning style theory to create a match between a student's preferred learning style and the learning method of the course. The learning methods include collaborative (traditional lecture), self-paced (individualized), and project-based (hands-on activities). Each Basic College Mathematics course follows the same curriculum and every student takes the same final exam. While there is no significant difference in the students' performance between the three courses, the student success rate in Basic College Mathematics is higher than the national average for two-year colleges.

Albuquerque Technical Vocational Institute, a two-year community college in Albuquerque, New Mexico, offers its students three ways to learn developmental mathematics in order to accommodate students' different learning styles. Students can choose a traditional lecture class, a self-paced class, or project-based classes in which students work in groups to solve projects. With enrollment approaching 24,000, TVI is the second largest postsecondary institution in New Mexico, following only the University of New Mexico. TVI is a multi-ethnic college with students consisting of 42% non-Hispanic, 3% African American, 39% Hispanic, 2% Asian or Pacific Islander, 7% American Indian or Alaskan Native, and 7% other.

Over 65% of all TVI students take at least one developmental course in the Division of Educational and Career Advancement (ECA). ECA offers students courses in nine disciplines that develop basic skills

necessary for success in college and careers. ECA also includes classes in English as a Second Language (ESL) and General Education Degree (GED) preparation. It is a multi-ethnic department with a student population consisting of 31.4% non-Hispanic, 3.7% African American, 46.4% Hispanic, 2.2% Asian or Pacific Islander, 8.7% American Indian or Alaskan Native, and 7.6% other. The average age of ECA students is 26 years old. With enrollment approaching 7,625, the Division of Educational and Career Advancement is the second largest department at Albuquerque Technical Vocational Institute. Of those 7,625 students taking classes in ECA, approximately 29% test into Basic College Mathematics.

According to Hiemstra and Sisco (1990), approaches to learning methods and learning styles must be handled in tandem for them to be most effective. Since the time of ancient Greeks, educators have struggled with this concept as they wondered how someone could possibly learn something new. Modern learning theorists take a more pragmatic approach. They believe in the need for a more practical and realistic approach to the idea of education. For many years, educators have noticed certain characteristics among their students in that they prefer certain methods of learning more than others. These characteristics, or "learning styles," form a student's unique learning preference. Learning style refers to the typical ways in which a person takes in and processes information and makes decisions. It is that consistent pattern of behavior and performance by which an individual approaches educational experiences. It is the composite of characteristic cognitive, affective, and physiological behaviors that serve as relatively stable indicators of how a learner perceives, interacts with, and responds to the learning environment (Bennett, 1990). Learning styles can be a support to teachers in the planning of group and individualized instruction. There are many expressions of learning styles in the literature. Some of the most common are visual—sights, pictures, diagrams, symbols; auditory— sounds; read/write—textbooks, handouts; kinesthetic—taste, touch, and smell.

These approaches to educational experiences or learning styles were used by the mathematics faculty in ECA to develop three learning methods for teaching Basic College Mathematics. The developmental mathematics curricula range from Basic College Mathematics which begins with whole numbers to Introductory Algebra which ends with quadratic equations. Developmental mathematics accomplishes its mission of assisting students in achieving both academic and personal goals by

offering developmental courses, tutoring, study skills seminars and workshops, computer-assisted instruction, and short- and long-term academic skills remediation.

The learning methods used to teach Basic College Mathematics include collaborative (traditional/lecture), self-paced (individualized), and project-based (hands-on activities). The collaborative learning method, which is a traditional/lecture style class, incorporates lecture, individual and group work, and individual and group activities to cover course material. The traditional/lecture format focuses on the visual representation of auditory information of words and mathematical symbols written in texts and handouts, on transparencies, or on a chalkboard. Since the learning method used in the collaborative learning method uses these approaches in the classroom, the visual and aural components of a student's learning style are matched successfully in this learning method.

The second method is self-paced which has the same curriculum as the other learning methods but allows the students to work at their own pace from the text and allows for open entry and open exit. An open entry/open exit course is one that allows students to enter the course up to the tenth week of the term. As long as course requirements are completed, students receive credit for the course. Research conducted by Price (1983) indicates that students who score above average on reading and writing tests do significantly better on tasks that are individualized. He proposes that students in this category be given the opportunity to work on tasks at their own pace and provide feedback on their progress through written reports. Since the learning method used in the self-paced learning method uses individualized instruction and allows the student to work at their own pace, the read/write components of a student's learning style are matched with this learning method.

The third method is project-based which is taught using a series of learning activities the students complete in groups. The kinesthetic learning style involves both information perception (touching, tasting, smelling) and information processing (moving, relating, doing something active while learning). Since the learning method used in the project-based learning method uses most of these methods during the class projects, the kinesthetic components of a student's learning style are matched with this learning method. All three courses incorporate the same curricula, same textbook and objectives, and the students take the same final exam. The only difference is the methodology in which the course is taught.

The first method, the collaborative learning method, uses the traditional/lecture method for the delivery of the material. The capacity of a traditional/lecture course is 25 students and typically meets two days a week for 15 weeks. The most common approach in a collaborative class is the instructor presenting the material in a lecture format. For example, if fractions are being covered in the traditional/lecture course, the instructor may begin the class with a brief lecture, then move to a guided practice and finally give the students a handout to complete the lesson. They may also reinforce the concept using individual or group handouts that provide more practice.

The second method, the self-paced method, uses individualized instruction and allows the students to proceed at their own pace. Because individualized instruction can be very time consuming these classes have a capacity of 18 students and, whenever possible, an instructional assistant is scheduled in the class to assist the faculty. Also, this course is open entry/open exit, which means that students may exit when they have completed the objectives. In addition, students are allowed to enter the class up to the 10th week of the semester. The faculty work individually with each student and, whenever possible, provide small group lecture; but most frequently, the students work one-on-one with the faculty or instructional assistant. In the self-paced class, the student reads and studies the text in order to understand the material while the instructor is present to answer questions. Also created for the self-paced course are comprehensive handouts given to students to supplement the text. These handouts are detailed and provide students with practice problems; students are also given answers to the practice problems. If the concept of the addition and subtraction of fractions was introduced in the self-paced method, the student would begin by reviewing the addition and subtraction chapter in their textbook and, if necessary, the faculty can suggest additional supplements. If the student has any questions, either the faculty member or the instructional assistant will sit with the student and answer any questions.

The third method, the project-based method, uses group activities to complete the objectives. The capacity of a project-based course is 25 and typically meets two days a week for 15 weeks. In addition to the normal textbook, this course also includes a supplemental manual. The supplemental manual consists of projects that support each corresponding section of the text and provides the student with contextual hands-on learning experiences. The faculty in the project-based class

serves as facilitators as the students complete the projects. For example, the concept of addition and subtraction of fractions is introduced by the instructor using the standard text and then the students are given various contextual projects to complement the text.

In the project-based course, students work in groups to solve projects. For example, one of the first projects used to introduce students to fractions is adding up the length of all the areas that process food in the human body. Student groups measure the various organs that food travels through the human body. At the end of the project, students have a total figure of the length. During the process, they have had to manipulate fractions through measurement to discover the total length.

The intent behind offering the course using three different learning methods is to give students as many options as possible to enhance success. ECA has experienced considerable success with these options. For students enrolled in the course in the spring 2004, the data show the completion rate for the traditional approach was 77%, 82% for self-paced, and 75% for the project-based method. Since these courses are taught as credit/no credit, completion rate is defined as the number of students who received at least a 71% overall average in the class and who also receive at least a 60% on the final exam. There is no statistically significant difference among student success rates in the three methods. Data show that students enrolled in each of the three methods do equally well. These completion rates are high compared to the nation's community college rate of students who pass remedial mathematics courses which is 66% (Lewis, Farris, & Greene, 1996).

This approach is innovative in that it incorporates the concepts of a student's learning style with a learning method for a distinct course. Since the Greeks, we have discovered that the question is not how someone can learn something new, but rather it is unrealistic to expect that a particular learning method will be successful for all learners. ECA's approach tries to create distinct approaches to learning methods, content instruction, and curricula organizations that specifically address students' learning styles. Instead of an "all or nothing" mentality, ECA recognizes that using a variety of approaches benefits learners. In this way, all students have an opportunity to be successful.

References

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