AC 2011-1809: ENHANCEMENT OF LEARNING OUTCOME, ENROLMENT AND RETENTION IN A NEW CONSTRUCTION MANAGEMENT PROGRAM

Tamara Chowdhury, Alabama A&M University

Tamara Chowdhury, Alabama A&M University. Tamara Chowdhury is an Assistant Professor & Coordinator of Construction Management Program in the Department of Engineering Technology at Alabama A&M University in Huntsville, AL. Mrs. Chowdhury has extensive background in teaching undergraduate students in the Department of Civil Engineering, Construction Management and conducting research. She also worked for a multinational research organization for many years. Mrs. Chowdhury earned her MS in Civil engineering from Clarkson University, New York, USA and B.S. in Civil Engineering from Bangladesh University of Engineering & Technology.

Enrichment of Learning Outcome, Increase Enrolment and Retention in a New Construction Management Program

Abstract

Student success and retention research in higher education has provided an immense understanding of factors that explain why students decide to leave, and to some extent, why students persist on to graduation. Based on a study/survey conducted, involvement of undergraduate students in research or hands on projects related to their discipline, field trip, financial assistance and proper mentoring were found to be among the top factors that can improve the learning outcome and retention of underrepresented minority students in applied technology.

The participation of skilled minorities in the national construction industry workforce is extremely low, which is a real concern and needs immediate attention to improve diversity. This paper first addresses the various causes of this low representation, and then discusses some remedies.

The Construction Management program's multidisciplinary approach at Alabama A & M University combines essential components of construction techniques with concepts of business management and behavioral science to develop technically qualified individuals for responsible management roles in the design, construction, and operation of major construction projects. The focus of the program is on the fundamental concepts and technical skills required to create a wide range of career paths in the construction profession. This paper shows that by introducing hands on project opportunities, field trip to under-construction projects, introduction to related software, hands-on lab work, contemporary education, financial support and through proper mentoring, the enrollment, retention and successful graduation of underrepresented minority (male and female) can be significantly increased which will lead to a balanced workforce and improve the national economy.

Background

In an increasingly competitive and technology driven global economy, there is a growing concern regarding ability of the U.S. to remain competitive. The 2006 American Competitive Initiative (ACI) program emphasizes that education is the gateway to opportunity and the foundation of a knowledge-based, innovation driven economy, and when it is accompanied with training and retaining it will provide the nation's workforce with opportunities for advancement and the ability to compete in a global economy. However, gaps in race/ethnicity and gender at entry and in completion of science, technology and engineering programs indicate that the U.S. struggles to develop a diverse workforce that can compete globally. Alabama Agricultural and Mechanical University (AAMU) is a historically black (HBCU) land-grant and EPSCoR

institution established in 1876 with a mission of providing high quality education for about 6000 underprivileged, mostly low-income African-American students. The university offers baccalaureate, masters and doctoral level degrees that are compatible with the times to all qualified and capable individuals who are interested in further developing their technical, scientific, professional, and scholastic skills and competencies. The ethnic distribution of students at AAMU is 92% black, 4% white, and 4% represented by all others. In the School of Engineering and Technology at AAMU, the distribution of students based on gender is 76% male and 24% female. AAMU set a priority to provide low-income students with higher education and ensure their success through retention, graduation, and advancement. Alabama A&M University, a center of excellence, provides an educational environment for the emergence of scholars, scientists, leaders, critical thinkers, and other contributors to a global society.

There continues to be a growing demand for graduates of the construction management profession in the national work force. The increasing complexity of construction projects is boosting the demand for management-level personnel within the construction industry. Sophisticated technology and the proliferation of laws setting standards for buildings and construction materials, worker safety, energy efficiency, and environmental protection have further complicated the construction process.

Advances in building materials and construction methods; the need to replace portions of the nation's infrastructure; and the growing number of multipurpose buildings and energy-efficient structures will further add to the demand for more construction managers. More opportunities for construction managers also will result from the need for greater cost control and financial management of projects and to oversee the numerous subcontractors being employed. The Bureau of Labor Statistics projects that excellent employment opportunities for construction managers are expected because the number of job openings will exceed the number of qualified individuals seeking to enter the occupation. This situation is expected to continue even as college construction management programs expand to meet the current high demand for graduates. In addition to job openings arising from employment growth, many additional openings should result annually from the need to replace workers who transfer to other occupations or who retire or leave the labor force for other reasons. More construction managers will be needed as the level of construction activity continues to grow. In addition, opportunities will increase for construction managers to start their own firms. The program is a comprehensive major in construction management and is unique in the state of Alabama. The program is designed to also allow students with an approved Associate of Applied Science (A.A.S.) Degree or Associate of Applied Technology (A.A.T.) Degree from a community college or technical college to obtain a 4 year degree in construction management. Numerous community colleges offering A.A.S. or A.A.T. programs in Building Construction Technology are very interested in this program.

The new Construction Management program at AAMU will meet the demand of students who are interested in construction management and is committed to prepare students, to work efficiently for various industries and government in the construction areas.

Causes of Low Enrollment of African American Students in Technology, Engineering and Construction

Developed countries like the United States need large technical professional workforce including construction. An increasingly strong demand is present for construction management graduates in the state of Alabama and nationwide. The construction industry has become a $500 billion dollar per year industry marked by continuous and dramatic change. The demand for capable and highly trained construction management professionals, who can adapt and become effective leaders in the field, remains strong. But unfortunately, the percentage of minority black student is very low compared to the percentage of their population[3,4]. To understand the reasons of poor representation of African American students in technology, the first step was to explore the probable causes. Hence, a survey tool was developed with possible causes for low enrollment of minority students in technology, particularly minority black students, and shown in Table 1. The survey tool was circulated among the minority students of Engineering Technology department at AAMU. The students were asked to rate their responses on a scale of 1 – 4. The student responses were compiled, averaged and presented in Fig. 1. In this figure, the horizontal axis denotes the item number for various causes as described in Table 1, and the vertical axis denotes the average rating for that particular item.

Table 1. Survey Tool for possible causes of low Enrollment of African American students in Technology & Construction.

Survey Tool for causes of low Enrollment of African American Students in Technology & Construction

In a scale of 1 to 4 (1 – minimum, 4 – maximum), rate the following items you believe might be possible causes for low enrollment of African American students in Technology & Construction:

Item #	Probable Reasons	Not Agree (1)	Somewhat Agree (2)	Agree (3)	Strongly Agree (4)
1	Lack of Motivation for challenging position				
2	Lack of proper Math and Science courses in High School				
3	Ignorance of job prospect				
4	Lack of exposure to construction work-environment and job pattern				
5	Ignorance of professional job salary compared to other jobs				

Survey Tool for causes of low Enrollment of African American Students in Technology & Construction In a scale of 1 to 4 (1 – minimum, 4 – maximum), rate the following items you believe might be possible causes for low enrollment of African American students in Technology & Construction:					
6	Fear of Math				
7	African American students have a general tendency to study Liberal Arts / Humanities subjects				
8	Lack of motivation or influence from Family to study technology				
9	Economic condition / Financial hardship				
10	Marital Status (Early Marriage or Teen Parent)				

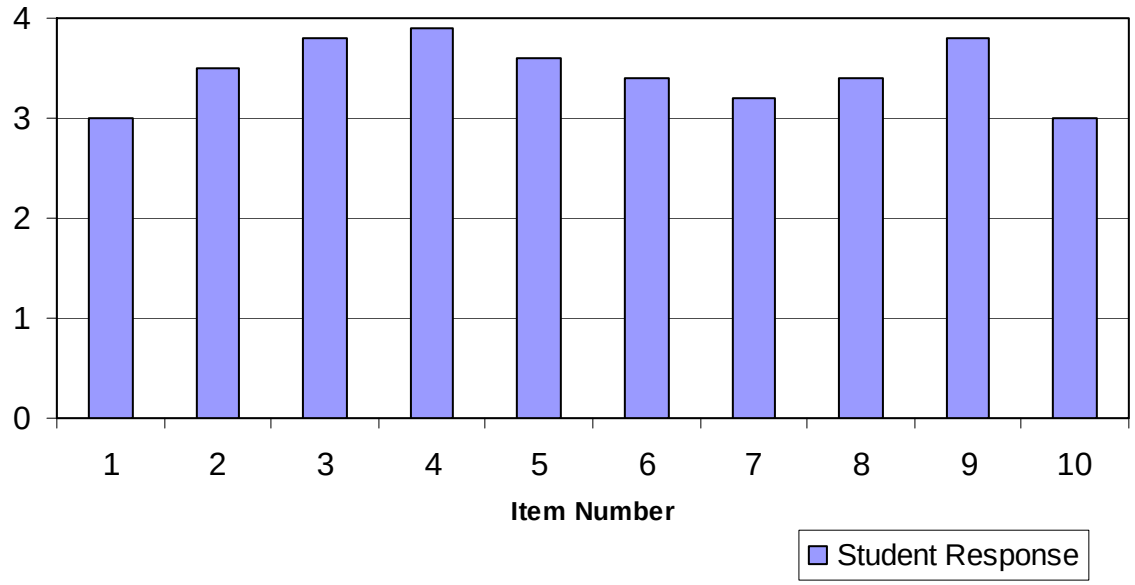

Fig. 1. Response of students about the items that might be possible causes for low enrollment of African Americans in Technology & Construction.

From Fig. 1, it is observed that almost all of the students strongly agree that minority African Americans are ignorant about technical and professional job prospect. In addition, most of the students agree that lack of proper Math and Science courses in high school, lack of motivation or influence from family to study technology, general tendency to study Liberal Arts or Humanities subjects, lack of exposure to work-environment and job pattern, and economic condition are some of the major factors that affect the enrollment of minority students in technology and construction.

To meet their financial needs such as tuition, book fees and lodging, approximately 90% of the minority students enrolled in different technology & engineering programs spend more time working different low-pay jobs instead of attending university. This leaves them tired and inattentive in class and they often show up late or not at all. Subsequently, this affects their grades and ultimately they are not interested in continuing their studies. But students who received financial support had a substantially higher retention rate and grades.

Solutions to Increase Underrepresented Students in Technology, Engineering and Construction

For finding the probable solution to increase enrollment and retention of African American students in technology a survey tool was also developed with some suggestions or ideas, and presented in Table 2. The survey was again conducted among the minority students of the Engineering Technology Departments at AAMU. The survey results were processed and presented in Fig. 2. In this figure, the horizontal axis denotes the item number for various probable solutions as described in Table 2, and the vertical axis denotes the average rating for that particular item.

In Fig. 2, it is found that the students strongly agree that more scholarships for freshmen and sophomore students, more summer internship opportunities for minority students, involvement of undergraduate students in research or projects related to their discipline, and providing adequate academic mentoring to the undergraduate students are needed to increase the enrollment and retention of African American students in Technology & Construction. In addition, giving proper idea about professional work environment and job pattern, and increasing awareness about job prospect and benefit for technical jobs among high school students would help to increase the enrollment of minority students in Technology & Construction.

Table 2. Survey Tool for possible solutions to increase minority students in Technology & Construction.

Survey Tool to increase Enrollment and Retention of African American students in Technology & Construction In a scale of 1 to 4 (1 – minimum, 4 – maximum), rate the following items that you believe might help to increase the enrollment and retention of African American students in Technology & Construction:					
Item #	Suggestions / Ideas	Not Agree (1)	Somewhat Agree (2)	Agree (3)	Strongly Agree (4)
1	More scholarships for freshmen and sophomore minority students				
2	Encourage minority students at high school to take math and science courses to prepare for technology & engineering				
3	Increase awareness about job prospect and benefit for professional technical jobs, among high school students				
4	Involve undergraduate students in research or projects related to their discipline				
5	Provide adequate academic mentoring to the undergraduate students, faculty and peer monitoring				
6	Arrange supplemental math and science courses for freshmen students				
7	Give proper idea about professional work environment and job pattern				
8	More Summer Internship opportunities for minority students				
9	Communicate with families to encourage students to study technology for better prospect				

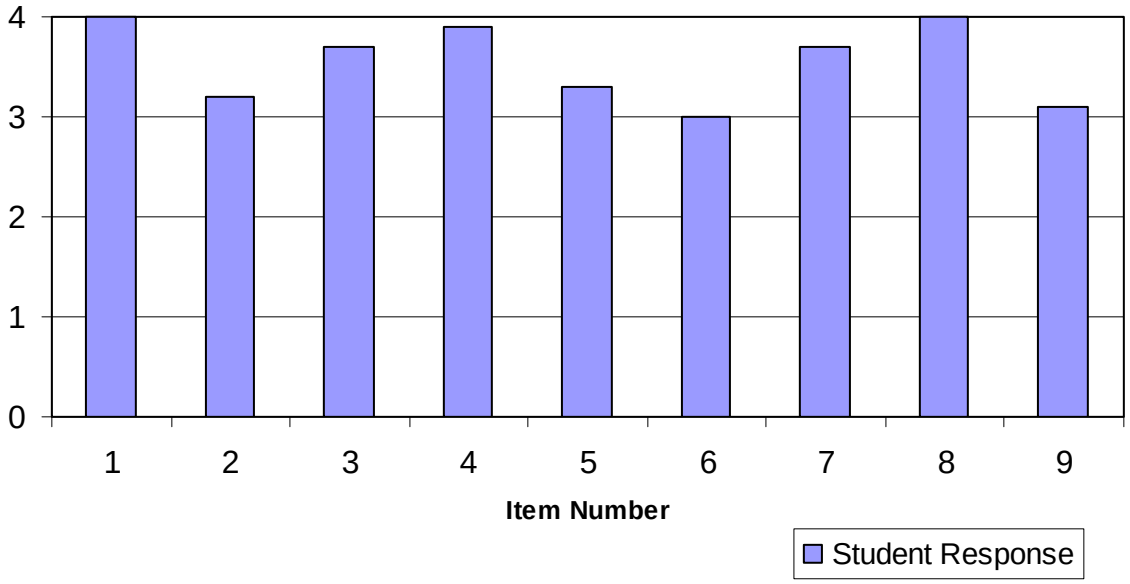

Fig. 2. Response of students about the items that might increase enrollment of African Americans in Technology & Construction.

Study on Assessment Tools for Enrichment of Learning Outcome and Retention

The assessment tools that were employed to measure and track learning outcomes of the course objectives and criteria are course assignments and projects. Team membership skills, class presentations, and the professional nature of a team's work (as judged by faculty and project manager) were worked into the assessment of the projects. The project-based course design and delivery approach involves the following:

- Employing 2 course instructors (Professor and Project Manager);
- Using a High-Tech Building Project
- The project is divided into manageable sections
- Students are introduced to each phase of the project
- Provision of guidance during phased projects
- Delivery of course notes in synchronization with projects and form theoretical basis of project solution.
- Solutions are discussed in class after each phase
- Better learning curve and shortened learning process.

Several groups of undergraduate Construction Management students were engaged in a challenging project, construction related internship, frequent field visit to the construction area and hands on experiment in the laboratory and field for different higher level courses. The students were involved in the design, construction, testing, reporting, and presentation of each

project. The activities involved diverse aspects such as planning and scheduling, purchasing, estimating, performing calculations and analysis, coordinating logistics, team work, design reviews and finally reporting and presentation. They were mentored by two faculty advisors from the technology department.

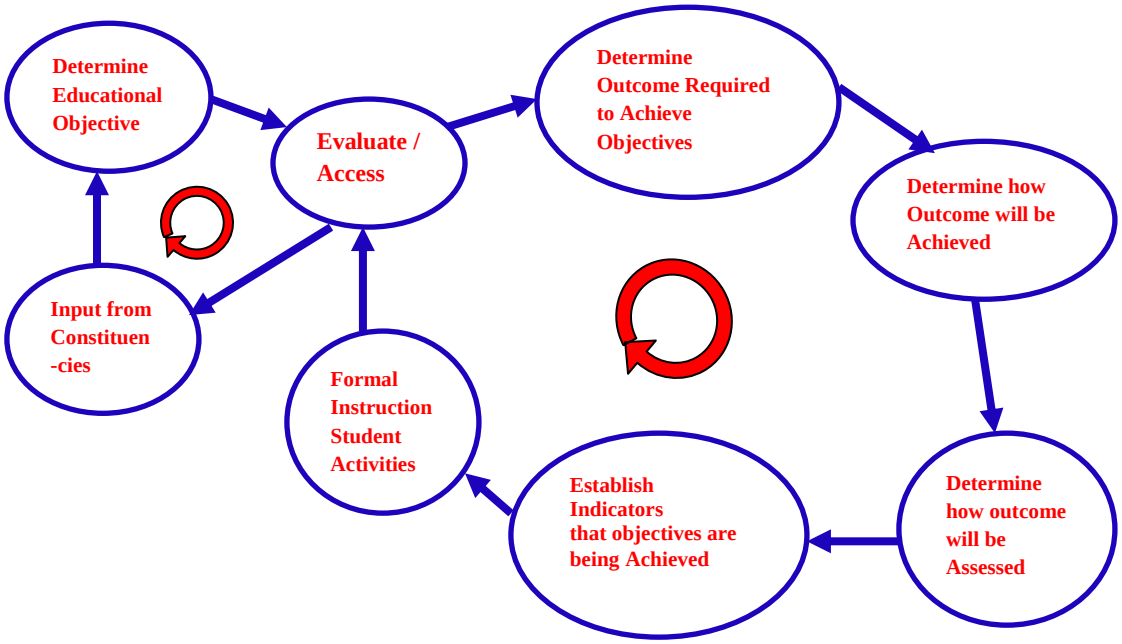

Figure 3: Evaluation and assessment Loops

Educational objectives are determined using inputs from the constituencies[1]. The constituencies are Accreditation Board[2], Industry, the University, etc. The entire process as depicted above is a continuous improvement process.

A survey was also conducted among these students involved in research or projects. The survey tool developed with possible suggestions or ideas to enhance the learning outcome and retention of African American students in technology is presented in Table 3. Responses to the survey were processed and presented in Fig. 4. In this figure, the horizontal axis denotes the item number for various suggestions as described in Table 3, and the vertical axis denotes the average rating for that particular item.

The survey shows that, these research/project experiences have brought excitement in the students' learning process, had a tremendous impact on their careers, motivated the minority students to become successful professionals, improved their learning outcome and self-

confidence, prepared them to join the national engineering workforce and improve diversity, and even motivated some of them to pursue graduate studies.

Table 3. Survey Tool to assess the enhancement of Learning Outcome and Retention of minority students in Technology due to undergraduate research/project.

Survey Tool to assess the enhancement of Learning Outcome and Retention of African American students in Technology & Construction

In a scale of 1 to 4 (1 – min, 4 – max), rate the following items that you believe might help to enhance the Learning Outcome and Retention of African American students in Technology & Construction:

Item #	Suggestions / Ideas	Not Agree (1)	Somewhat Agree (2)	Agree (3)	Strongly Agree (4)
1	Financial Assistance for the undergraduate minority students				
2	Involvement of undergraduate students in more hands on projects				
3	Involvement in research/project brought excitement in the learning process				
4	Involvement in research/project related to the practical field				
5	Involvement in research/project improved student's learning outcome				
6	Involvement in research/project prepared the students to join the national workforce and improve diversity				
7	Involvement in research/project motivated the students to pursue graduate studies				
8	Provide adequate academic mentoring to the undergraduate students				
9	Give proper idea about professional work environment and job pattern				
10	More Summer Internship opportunities for minority students				

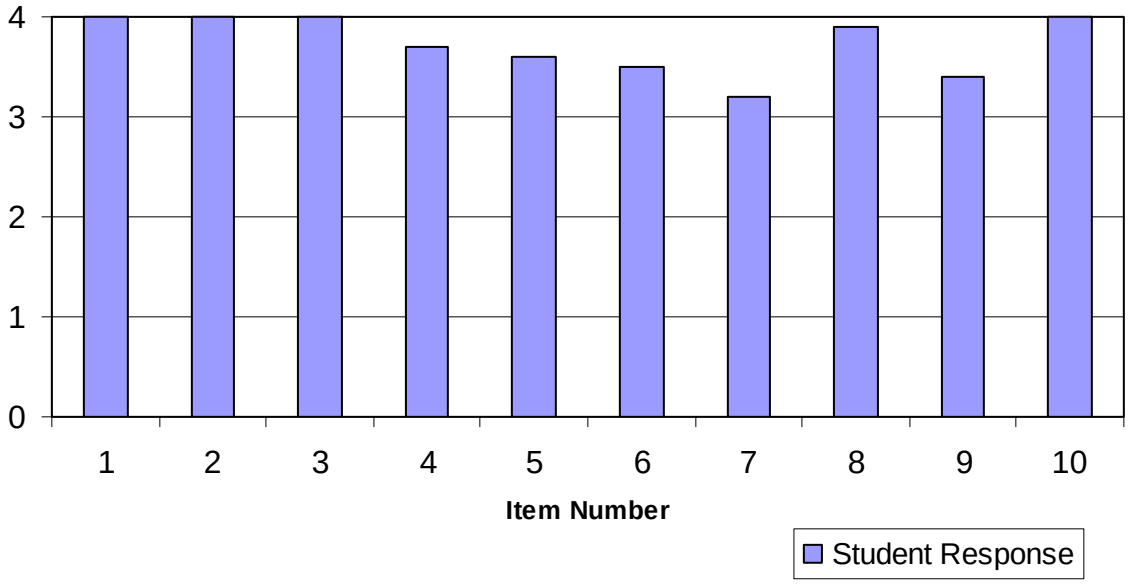

Fig. 4. Response of students about the items that might enhance the Learning Outcome and Retention of African American students in technology and construction.

This innovative project-based course design and delivery was employed to bring a real-world project into the classroom. The approach involved dividing a typical real-world project into manageable sub projects for the students to manage. Students were teamed up into groups of 3 or 4 and asked to manage a different aspect of the project. They presented their work in a typed format together with all the supporting documents at the end of each project phase. They were also required to make Power point presentations to the class and answer a number of questions from the Project Manager and the Professor. At each phase of the project, students were given lectures, and other materials to aid the solution of the problems in the sub-project. Assessment criterion was used to assess the course outcomes. It is evident from this work that students can be made to learn real-world problem solving skills in the technology classroom. This work has shown the use of bit-size project-based approach coupled with the appropriate guidance in the form of a project manager and course work can be beneficial to students. It however requires additional resources and a lot of dedication on the part of the Professor, Project Manager and the students to make it work well. This innovative approach can be used together with the traditional capstone course to enhance the problem solving skills of students. This knowledge may however serve as the experience for the capstone course for Construction Management students. Construction Management students are required to take capstone course in their final year of studies to prepare them for the construction industry.

Conclusion

This paper shows that by introducing undergraduate research opportunities, financial support and proper mentoring, the enrollment, retention and successful graduation of underrepresented

minority African American Engineers (male and female) can be significantly increased which will lead to a balanced workforce and improve the national economy. The innovative project-based course design and delivery which brought a real-world project into the classroom highly encouraged and motivated the students to retain and successfully graduate.

Bibliography

1. "Designing a Project Based Construction Engineering Course", 2007 ASEE Annual Conference, AC 2007-2221, Honolulu, Hawaii.

2. "Criteria for Accrediting Engineering Programs" Effective for the 2007-2008 accreditation cycle, ABET, Engineering Accreditation Commission (EAC), ABET Inc., Baltimore, MD.

3. "Alabama A&M University Business Cluster Conference", 2009, Huntsville, AL.

4. "Strategies for Success: Enhancing Minority Student Success in Science, Engineering and Technology Professions", Session 3470, 2004 ASEE Annual Conference and Exposition, Salt Lake City, Utah.