BUILDING SELF-ESTEEM THROUGH A COOPERATIVE LEARNING BLACKS IN SCIENCE

Edward N. Prather[1]

Abstract *—Based on the graduation rate reported in the 1999 NACME Research Letter, new strategies that are designed to improve the retention of African American, Hispanic, and Native American students in science, mathematics, and engineering (S.M.E) majors are sorely needed. According to the NACME report, a minority student entering an engineering college is only half as likely to obtain a bachelors of science degree in engineering as a non-minority student. It has been observed that the literature presented in a Blacks In Science course has had a positive effect on the students' self-esteem and has positively influenced their persistence in engineering. This paper discusses some of the unique reasons why African American students switch from S.E.M. majors and describes how a Blacks in Science course can be part of an innovative solution to this problem. In addition, this paper discusses various cooperative learning strategies and describes the specific methods used in the course.*

Index Terms —Self-Esteem, Minority Engineering Students, Retention, Cooperative Learning

INTRODUCTION

Numerous African-American educators, social scientists, psychologists, and psychiatrists agree that an individual self-concept or identity is shaped by the social interactions within one's environment rather than being inborn [1]-[5] "et al." Many of the ideas and theories these scholars built upon were published in the seminal publication Negro Self-Concept [6] which included a collection of position papers presented at a 1963 conference held at Tufts University.

Goffman [7] held that social interactions between ethnic minorities and Whites have caused the former to develop "spoiled identities." Negative beliefs that are generalized to an entire ethnic group are defined as stereotypes [8]. A particular set of stereotypes has applied to African Americans, Hispanics, and Native Americans in an attempt by Whites to dominate these groups [8]. The generalized stereotypes include: laziness, lack of intelligence, and lack of ambition. In contrast, the generalized stereotypes of Asians include: too ambitious, overly competitive, clannish, and self-interestedly intelligent. Akbar [9] noted that students from these groups often fell victim to these negative stereotypes if internalized and often developed a conscious or unconscious self-hatred.

Through one-on-one advising sessions, the Assistant Dean in the College of Engineering at the University of Cincinnati who manages the Emerging Ethnic Engineers (formerly the Minority Engineering Program) often observed the internalization of these negative stereotypes in African American engineering students. The internalization of these negative stereotypes frequently manifested into, if not self-hatred, at least self-doubt and a covert lack of self-confidence in their ability to successfully complete their engineering degree. In an attempt to build their confidence, the Assistant Dean would share information about the contributions that Africans and African Americans have made in the fields of science and engineering throughout history and suggested that it was very conceivable that with hard work and commitment they too, could do the same.

DISCUSSION

In the 1994 ethnography by Seymour and Hewitt, "Talking About Leaving: Factors Contributing To High Attrition Rates Among Science, Mathematics, & Engineering Undergraduate Majors," they observed, through interviews, that many of these generalized stereotypes about ethnic groups existed on the college campus. Many White students held the stereotypical belief that African Americans and Hispanics as a group were less intelligent than Whites and Asians. This belief was demonstrated by White students' assumption that affirmative action policies lowered admissions requirements in order to admit African-American and Hispanics students. These negative stereotypes affected the confidence of African Americans and Hispanics concerning persistence in S.M.E. majors.

The interview data supported the notion that minority students held stereotypes about other ethnic groups similar to the stereotypes held by the dominant culture. In general, African Americans saw Asians as smart and asocial, and Asians saw African Americans as less motivated and non-competitive. Seymour and Hewitt noted that some students of color who were women or athletes carried an additional burden. A unique stereotype of Asian American students was that Whites stereotyped them as foreigners.

The text data revealed the damage that can result from the internalization of stereotypes: feelings of inferiority, self-hatred, or hatred of one's own group. Students identified three surprising sources of internalized stereotypes: their

Edward N. Prather, University of Cincinnati, Emerging Ethnic Engineers Program, 680 ERC Building, OH 45221 eprather@uc.edu[11]

community, pre-college teachers and counselors, and campus minority programs.

A lack of confidence and self-doubt were rarely expressed by White students but these feelings came up frequently in conversations with students of color. Even minority S.M.E. students about to graduate expressed feelings of inadequacy. These students unanimously agreed that without student support groups they might not have been able to persist in an S.M.E. major. These groups prevented social isolation and feelings of being alone.

Ethnic isolation was observed as a problem for S.M.E. students of color. It contributed to their decisions to "switch" and it increased their perception of prejudice. Seymour and Hewitt made it clear, however, that perceptions of racism were more than just subjective feelings: students of color in fact experienced acts of racism. The main point that the data revealed was that these unpleasant realities took on an even greater significance if the students were isolated and had no one from their own ethnic group who could understand their pain and with whom they could share the experience.

Unlike White students, minority students were keenly aware of the difference between prejudice (belief) and discrimination (action). White students felt that if a discriminatory act had not occurred, then no feelings of prejudice existed and minority students were just crying racism. For minority students, however, feelings of prejudice had as negative an effect on their academic performance as observable acts of discrimination.

Minority students felt that being a token representative of your ethnic group increased the pressure to do well and at the same time inhibited your willingness to ask for help. The text data clearly showed that ethnic isolation increased the likelihood of switching majors for minority S.M.E. students.

Minority Critical Mass and Prejudice

Seymour and Hewitt noted, "The higher the representation of an ethnic group in S.M.E. majors, the more resentment of that group was expressed by White students. Conversely, the lower the representation of an ethnic group, the less prejudice was expressed by White students, and the more favorable the attitude toward the members of that ethnic group" (p. 494). Their data revealed that when the number of ethnic students in S.M.E. majors reached a critical mass ethnic students perceived a level of acceptance; at the same time, the existence of a critical mass led to reactions of White prejudice and attitudes opposing affirmative action programs. This finding provides new information that opposes the conventional theory that the more education one has, the less likely he or she is to express ethnic prejudice. This theory was grounded in the thought that when poor people feel that their economic security is being threatened, they are likely to exhibit prejudice toward their competitors. Seymour and Hewitt argued that this finding demonstrated that this reaction extends across all class lines, regardless of income and education. They concluded that the variable that explains the level of one's prejudice is economic security, not level of education. The economic threat for students was competition for future employment.

There is a logical explanation for why ethnic minority groups, which had reached a critical mass on campus, did not perceive resentment or prejudice from White classmates: they were able to physically and socially insulate themselves from the White majority. They protected themselves from negative stereotypes by developing close-knit groups that provided affective and cognitive support, allowed them to view the campus more positively, and enhanced their ability to persist.

Seymour and Hewitt's study went beyond the usual numerical description of the serious S.M.E. retention problem of minority switching to report the personal pain, frustration, and self-blaming that these students experienced in deciding to leave S.M.E. majors. Minority students reported feeling pushed away by a dominant group that felt they had nothing to offer, not being pulled toward a more attractive career aspiration. For many minority students, the decision to leave an S.M.E. major was based on their desire to stay in college and earn a degree.

BLACKS IN SCIENCE COURSE

In 1992, the Blacks In Science Course was developed by the author of this paper. Taught out of the department of African American Studies, this three credit course extends over one quarter and fulfills a Humanities elective for engineering students. The course is open to all students, however, freshman students in the Emerging Ethnic Engineers Program are especially encouraged to enroll during fall orientation. The course is taught once a year during the fall quarter and has had an average enrollment of approximately thirty students. Ivan Van Sertima's Blacks In Science: Ancient and Modern [10] and Anthony T. Browder's Nile Valley Contributions To Civilization [11] have been used as texts.

The primary purpose for designing the Blacks In Science course was to provide students with information about the contributions of Africans and African Americans to S.M.E. fields. In addition, the internalization of this information can have a positive effect on the students' self-concept because your identity is shaped by the social interactions within one's environment. One of the most influencing forms of social interaction occurs through the educational process. Acknowledging the contributions of people who look like you and in fact are ancestors strengthens your self-confidence and the belief that you can follow in their footsteps [9]. For Caucasian and other non-Black students, this course provides information that can help them adjust their perceptions of Africans' and African Americans' abilities and their contributions to not only science and technology but to the development of

civilization in general.

The first reading assignment, "Origin Of The Ancient Egyptians" by Cheikh Anta Diop from the book Egypt Revisited [12], sets the stage for the course. The reading reveals that the ancient Egyptian people during Egypt's "Golden Age" were of African descent.

The knowledge that your ancestors were the first to develope scientific principles like the measurement of time (i.e. second, minute, and hour) enhances your self-confidence and strengthens your belief that you too have ability to excel in S.M.E. The Ancient Egyptians (i.e. Africans) were not only the architects of the first stone building but they also built one of the seven wonders of the world, The Great Pyramid of Giza. The precision of this massive structure demonstrates that their knowledge of advanced mathematics was second to none. "Much of what is known about Nile Valley mathematics can be found in a document called the Rhind Mathematical Papyrus. This ancient papyrus was believed to have been written during the Middle Kingdom (ca. 1900 BC). Some of the problems addressed in this papyrus include the surface of the sphere, the square root (Pythagorean Theorem), the quadrature of the circle, the volume of a sphere, and the methods for determining the surface of the circle, rectangle, trapezium and triangle" [12] p 12.

The realization that these African people were world renowned for their knowledge of engineering, astronomy, medicine, navigation, and even aeronautical engineering (as evidenced by the discovery of a monoplane model labeled the "Glider of Saqqara" by the International Aerospace Education Committee) has a positive effect on the students' self-image. This observation can be substantiated through several studies outlined in Nancy L. Arnez's article "Enhancing the Black Self-Concept through Literature" [13].

In order provide an opportunity for students to work in groups, a cooperative learning instructional approach is used in this course. Structuring the course in this manner allows the students to develop the collaborative skills that will help them form academic support groups outside of the classroom. As mentioned earlier in Seymour & Hewitt's 1994 ethnography, students unanimously agreed that without student support groups they might not have been able to persist in an S.M.E. major.

According to Slavin, cooperative learning is an instructional system designed to encourage students to work in a collaborative manner toward a common goal [14]. It involves learning methods and techniques that use cooperative task structures in which students spend much of their class time working in four-to-six member heterogeneous groups. The system uses incentive structures in which students earn recognition, rewards, or (occasional) grades based on the academic performance of their groups.

The specific cooperative learning method used in the Blacks In Science Course is called Jigsaw. Students are placed in groups of four. These groups are referred to as Base Groups. Each week the class is assigned four reading assignments. The students in the Base Groups assign each other one of the four readings. After reading their assignment, each Base Group member makes an outline and emails it to the other members in their Base Group at least three days prior to class. When the students arrive in class, each student who was assigned reading number one from each Base Group comes together and forms an "Expert Group." Each Expert Group discusses the assigned reading in an effort to explore and synthesize pertinent information to bring back to their Base Groups. After twenty minutes of discussion, the students return to their Base Groups. Each Base Group member leads a ten minute discussion and question and answer session about their reading assignment. The class instructor then leads a class discussion focusing on pertinent information and issues from the four readings. This method is described below in the methods section of the following cooperative learning overview.

Essential Components of Cooperative Learning

According to Johnson and Johnson [15] there are five essential components that must be included for small group learning to be truly cooperative:

1. Positive interdependence exists when students perceive that they are linked with group mates in such a way that they cannot succeed unless their group mates do (and vice versa), and/or that they must coordinate their efforts with the efforts of their group mates to complete the task.
2. Cooperative learning requires face-to-face interaction among students within which they promote each other's learning and success. It is the interaction patterns and verbal interchange among students promoted by the positive interdependence that effect education outcomes.
3. The third essential component is individual accountability, which exists when the performance of each individual student is assessed and the results given back to the group and the individual. It is important that the group knows who needs more assistance, support, and encouragement in completing the assignment. It is also important that group members know that they cannot "hitch-hike" on the work of others.
4. The fourth component of cooperative learning is the appropriate use of interpersonal and small group skills. Persons must be taught the social skills required for high quality collaboration and be motivated to use them if cooperative groups are to be productive.
5. The fifth essential component is group processing, which exists when group members discuss how well they are achieving their goals and maintaining effective working relationships. Effective group work is influenced by whether or not groups reflect on how well

they are functioning. (p. 57)

Methods

The "engine" that runs cooperative learning is always the same: heterogeneous groups working toward a common goal [16]. Three prominent cooperative learning methods have been developed by Slavin to meet the practical needs of the classroom. These methods have also been designed to solve problems inherent in cooperative situations. One set of these methods is called Student Team Learning. Student Team Learning includes Student Teams Achievement Divisions (STAD), Teams-Games-Tournaments (TGT), and Jigsaws. The remaining two cooperative learning methods are Learning Together and Group-Investigation. Slavin describes each of these methods:

Student Team Learning

In Student Teams Achievement Divisions (STAD), the teacher presents a lesson and then the students meet in four to five member teams to master a set of worksheets on the lesson. Then each student takes a quiz on the material. The scores that the students contribute to their teams are based on the degree to which the students have improved over their individual past averages. The teams with the highest scores are recognized in a weekly class newsletter.

Teams-Games-Tournaments

Teams-Games-Tournaments (TGT), is similar to STAD, except that the students play academic games as representatives of their teams instead of taking quizzes. Students compete with others of similar achievement so that, as in STAD, any student who prepares can be successful.

Jigsaw

Jigsaw was one of the earliest of the cooperative learning methods [17]. In Jigsaw, each student in a five to six member group is given unique information on a topic that the whole group is studying. After the student have read their sections, they meet in "expert group" with their counterparts from other groups to discuss the information. Next, the students return to their groups and teach their teammates what they have learned. The entire class may take a test for individual grades at the end.

Jigsaw II

Jigsaw II [18] is designed to integrate original Jigsaw with other Student Team Learning methods and to simplify the teacher preparations required to use the method.

Learning Together

The method that is closest to pure cooperation is called "Learning Together" [19]. Students work in small groups to complete a single worksheet, for which the group receives praise and recognition. This method emphasizes (1) training students to be good group members and (2) continuous evaluation of group functioning by the group members.

Group Investigation

The Group-Investigation method is the most complex of all the cooperative learning methods [20]. It calls for students in small groups to take substantial responsibility for deciding what they will learn, how they will organize themselves to learn it, and how they will communicate what they have learned to their classmates. Each group takes on a different task and then allocates sub tasks among the members. The tasks often involve open-ended investigations using a variety of resource materials. Ultimately, the groups prepare reports to present to the rest of the class.

Cooperative Learning Research

Slavin [14] identified 46 field experiments in elementary and secondary schools that had studied the effects of cooperative learning on student learning. These experiments used control groups that lasted at least two weeks, but most of the experiments lasted 8-16 weeks. Of the 46 experiments, favorable effect on student achievement was found in 29 experiments, no difference in 15. In 2 experiments there was a significant difference favoring the control group. After a detailed review of the studies, Slavin [16] concluded that individual accountability and group rewards are necessary if cooperative learning is to have positive achievement effects. If the learning of every group member is not critical to group success, or if group success in not rewarded, achievement is unlikely to be increased above the level characteristic of traditional classrooms. There is some tendency for Blacks and other minority-group students to gain especially in achievement as a result of working cooperatively.
Slavin also concluded that the mechanisms by which cooperative learning affects student relationships are unclear. It is not clear whether cooperative learning really changes cross-ethnic and cross-handicap relations in out-of-class and out-of-school situations. Carry-over of cross-ethnic and cross-handicap friendships to generalized attitudes toward other ethnicities or handicaps also need to be assessed in more detail.

Slavin [16] raised the following issues that touch on underlying societal issues:

"Perhaps the most important issue that cooperative learning research will raise is, how do we want our children to be socialized? Do we want them to learn how to live in a culturally pluralistic society where they can become active participants in learning, or do we want them to become passive learners that just intake and regurgitate information. The present system of competitive and individualistic instruction reinforces the latter. The responsibility cooperative learning places on the student for, not only his learning, but also for the learning of other members in his group has the potential for developing a more conscious and responsible person" (p. 103).

RESULTS

Approximately two hundred and seventy (270) African American students have taken the Blacks In Science course. Of the approximately one hundred and twenty students who are old enough to be seniors, 45% have graduated compared to an overall University African American graduation rate of approximately 30%.

CONCLUSION

In an attempt to improve the persistence and graduation rates of African American students, the Blacks In Science course strives to improve the self-concept of African American students in general and particularly of those who are majoring in engineering. Up to this point, no data are available to scientifically prove that the course, in fact, improves the self-concept and self-esteem of the students who take the course. However, the literature points to scientific studies that prove that the self-concept of African American students improves when they are exposed to literature that focuses on the history and culture of African American people [21Georgeoff, 1967).

The results show a 15% higher graduation rate for African American students who took the course compared to those who did not. However, it is difficult to attribute these results solely to the course because the engineering students who are enrolled in the course participate in other academic enhancements that could also be contribute to their success. In order to measure the impact of the course on the students' self-concept and academic success, a qualitative research study should be conducted. In this type of study, students would have more opportunity to express how much impact the course had on their self-concept and academic success.

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