AC 2012-3728: PERSPECTIVES ON THE LEARNING ENVIRONMENT: CLASSROOM CULTURE AND SOCIAL TRANSACTIONS AT AN HBCU

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Perspectives on the Learning Environment: Classroom Culture and Social Transactions at an HBCU

Abstract

The learning environment is critical to the quality of the higher education experience. Classroom culture and the peer-to-peer and instructor-to-peer transactions that occur within the learning environment play a significant role in student academic performance. With the great demands that have been placed on the United States to produce a competent, diverse, globally engaged STEM (science, technology, engineering, mathematics) workforce, it is imperative that research focus on the learning experiences of this particular group of students. The present research addresses the current concerns through employing both quantitative and qualitative methods to understand the classroom culture and social transactions of African American male engineering students at an Historically Black College and University (HBCU), utilizing their authentic voice. Social cognitive theories of motivation have been used to investigate the meanings associated with cognitions about abilities and attributions. Results of the study reveal the following emergent themes: peer support, classroom culture and faculty/mentor support. The data indicate that through peer networks, a significant portion of a student's academic life is experienced as a family, which provides them with support, encouragement, motivation, guidance and assistance to persist. Conversely, course difficulty and individual professors with undesirable teaching styles negatively affected the learning environment. Additionally, the one factor that was correlated with students' overall satisfaction with their collegiate experience was their satisfaction with faculty instruction. The current research may not only have implications for HBCUs, but for all institutions educating minority engineers. A premium needs to be placed on the formation of peer groups. Although campus-wide events may be initiated with a similar goal in mind, engineering departments may need to create a way to foster this sense of community, which in turn may effectively enhance the learning environment, reduce attrition, increase academic performance and ultimately aid in the production of well needed, competent minority engineers.

Introduction

Learning environments, where students actively participate is one factor that has been found to have a positive influence on learning. Three main factors comprise the learning environment: individuals, relationships among those individuals, and the culture within the environment[1]. More specifically, Johnson [1] specifies that the definition of the learning environment is as perceived by the individual. This implies that what truly gives meaning to the learning environment is the lens through which one sees it. This study attempts to utilize this definition to enhance our understanding of students' perceptions of the classroom culture and social transactions within their engineering program.

The current study stems from current concerns regarding the present state of the engineering field. Recently, there have been great demands placed on the United States to produce a proficient, diverse, globally engaged STEM (science, technology, engineering, mathematics) workforce, who can address the critical challenges facing our nation[2]. Because of the anticipated change in the country's demographics there will be a need for increasing the number of

minorities in STEM. Accordingly, there is a critical need to increase the number of African American males who have a disproportionately low representation in engineering disciplines. Although more than 80% of all engineering degrees are being awarded to men, males make up less than 70% of the engineering degrees awarded to African Americans, and their numbers are dropping[3]. According to recent statistics, while White students have a 66% retention rate, the retention rate of underrepresented minorities in engineering programs is 40%[4]. In comparison to their mainstream peers, minority students are less likely to complete degrees in engineering[5]. Hall and Rowan [6] make a significant claim that, "[…] both African American males and the institutions where they might be educated have put forth less than the necessary effort to reduce attrition and increase graduation rates."

Historically Black Colleges and Universities (HBCUs) are institutions that were established with the intention of serving solely African American populations[12]. Up until the mid 20th century, HBCUs enrolled most of the African American students who sought higher education. Today, although HBCUs only graduate less than half of the country's African American students each year[12], they remain the nurturing, supportive environment needed for those who may not succeed elsewhere. For this reason, it is imperative that HBCUs take the lead on improving the retention of African Americans, especially in the STEM fields.

The literature points to some basic factors affecting student persistence/retention in undergraduate engineering studies. These factors include but are not limited to: self-confidence, attitudes towards engineering, quality of instruction, and the quality of the college experience. Seymour and Hewitt[7] looked at student persistence within the STEM fields. This study was a large three-year ethnographic study, utilizing 335 students from seven four-year institutions. Approximately 75% of the study's data were collected through interviews while 25% were collected through focus groups. One main goal of the study was to look at characteristics of those who switch from STEM majors and those who remain. Traditionally, it has been thought that those students who do not persist in the STEM fields are not able to, due to their lack of ability to cope with the difficulty of the field as well as their lack of commitment to hard work. However, this study found, that it was not the case. Factors that were found to lead to students' lack of persistence within STEM fields included: disengagement, poor teaching and the lack of peer group support.

More recently, Cole[8] examined the peer-instructor transactions of minority college students' academic achievement. The study used a sample of 2,073, African American, Asian American and Latino/a students from 10 Predominantly White Institutions (PWIs). This study found that the learning environment did not have the same effect for all minority students. Peer-to-peer and peer-to-instructor transactions had a greater affect on African American students' academic performance. Due to limitations of the quantitative design, what this research does not offer are the specific mechanisms within these transactions that affect African American students.

To date, research that has directed attention towards the learning environment has been lacking one component: the perspective of the individual. Much research that has been conducted on the learning environment has employed predominantly quantitative methods[1]. However, recently, there has been a cry for the inclusion of both quantitative and qualitative methods in the study of learning environments[1]. This is one contribution that the current study aims to make. A second

contribution is that while much research has focused on factors within the learning environment that may lead to the persistence and retention of minority students, the major studies that have generated these findings have examined the underrepresented populations in PWI environments. This study proposes to understand the classroom culture and social transactions of African American male engineering students at an environment/institution where the underrepresented student is the majority, through the following points of inquiry:

1. What are students' perceptions of the classroom culture and social transactions within the engineering program?
2. How do these perceptions impact students within the engineering program?

The main framework driving the present research is Bandura's[9] Social Cognitive Theory. This theory is a learning theory that has been utilized particularly in the field of psychology and education. The social cognitive theory proposes that it is through the influence of the individual, behavior and the environment that generates learning[9]. This concept is what Bandura[9] called the, 'triadic reciprocality'. The individual is not driven by the environment; nor is the environment by the individual. They mutually have the ability to influence one another and therefore interact with one another to create learning.

Methodology

The data from this study was collected during the first year of a two-year study funded by the National Science Foundation (NSF). The current investigation examines the classroom culture and social transactions of African American male engineering students at an HBCU. The research methods are described below.

Participants

Institution Profile
Data were collected from an HBCU on the east coast of the United States of America. This institution has long been a leader in producing engineers of exceptional quality from underrepresented minority groups, particularly African Americans. Offered at this institution are BS degrees in five engineering disciplines—chemical, civil, electrical, mechanical engineering and systems & computer sciences. The 2009 enrollment for this institution was 386 undergraduates of which 248 are male and one-third are international students. It is interesting to note that while men outnumber women in most US engineering schools at a 4:1 ratio, at this institution, the male to female ratio among engineering students is only about 2:1. Approximately 50% of first year students are retained and continue to their sophomore year in the engineering program annually. However, faculty demographics are quite similar to those reported for other HBCUs with 46% African American professors, 19% White, 17% Asian, 11% African and 7% Afro-Caribbean.

Seventy African American male engineering students were randomly selected to participate in the current investigation. The sample was recruited via email invitations and other promotional materials posted in the engineering department. After interested students were identified they were placed into one of four classifications: (1) freshman, (2) sophomore, (3) junior, (4) senior.

Students from each group were then randomly selected to participate. Efforts were made to ensure that the numbers of students selected for each group were representative of the population of engineering students in those classifications. Further efforts were made to include an equal number of U.S born and international students while retaining a randomized sample.

While seventy students were recruited to participate in the study, only forty-nine of the seventy students participated in the online survey. Of these students, 12% were seniors, 33% juniors, 35% sophomores and 20% were freshman. Represented in this sample were students majoring in all five engineering disciplines offered at the institution. Approximately 88% of students reported being 24 years of age or younger, while 6% of participants reported being between the ages of 25 and 29 and 2% reported being between the ages of 30 and 34. Seventy-eight percent (78%) were U.S. citizens and 22% were international students. These international students were predominantly from Africa and the Caribbean. Approximately 75% of students reported coming from low to middle income homes.

Thirty six (36) of students were recruited from the initial population to participate in semi-structured interviews. This was done using random stratified sampling to control for classification and U.S. citizenship.

Instrumentation

Surveys

Quantitative data was collected during the spring of 2011 using an electronically administered survey. The student survey instrument that was used to collect quantitative data is a modified version of the Persistence in Engineering Survey (Eris et al., 2005). The internal reliability of the modified scale is .84. This instrument was used to probe student satisfaction with and frequency of, faculty interaction in their engineering programs, as well as, student overall satisfaction with their collegiate experience. Student-faculty satisfaction was broken down into 3 domains: faculty advising, faculty availability and faculty instruction. These questions asked participants to, 'Rate your satisfaction with this institution on each of the aspects of campus life listed below: (1) Quality of instruction by faculty, (2) Quality of advising by faculty and (3) Availability of faculty. These items utilized a 4-point scale with responses: *Very Dissatisfied, Dissatisfied, Satisfied and Very satisfied*. Faculty interaction frequencies were broken down into 3 domains: interaction during class, interaction during office hours and interaction outside of class and office hours. These questions asked participants to report, *"How often have you interacted with the following people during the current school year (e.g., by phone, email, IM, or in person): (1) faculty during class, (2) faculty during office hours and (3) faculty outside of class and office hours."* These items utilized a 6-point scale with responses*: Never, 1-2 times per semester, 1-2 times per month, once per week, 2-3 times per week and daily*. Student overall satisfaction with the collegiate experience was also assessed as it has been found to be closely related with student persistence. Additionally, surveys were used to collect demographic information from students.

Semi-structured interviews

A stratified random sampling technique was employed to select 36 interview participants from the seventy (70) original participants. The semi-structured interview design was comprised of a standardized list of questions asked the same way to each participant and allowed for additional probing where deemed necessary. The probes provided the interviewers with a way to draw out more complete stories from the participants. The interviews focused on factors that influenced students' persistence within the engineering program. These interviews were administered during the last month of classes in the same semester as the surveys. All interviews lasted approximately 30-45 minutes. Each of the interviews was conducted by a trained research team member and were audio taped and professionally transcribed.

Procedures

The data for the current study was collected over the course of the fall semester. Employed in the current study, was a pragmatic approach, where the researchers utilize both qualitative and quantitative research methods to address the research problem, research question(s), and research circumstance. Surveys were used to gather quantitative data, while semi-structured interviews were used to obtain qualitative data. Both the survey and semi-structured interview data were collected and analyzed separately.

Results

Quantitative Analysis: Survey

The survey provided the quantitative data to examine students' perceptions of the classroom culture and social transactions. Means and standard deviations were calculated for level of satisfaction for faculty advising, availability and instruction. The higher the score the more satisfied students were with student-faculty interactions. Descriptive analysis revealed that on average, students reported being dissatisfied with advising; availability and instruction of the faculty in the engineering department at their institution (see Table 1). The responses for student-faculty interaction were assessed on a 4-point scale, with four possible choices*: 1- very dissatisfied, 2- dissatisfied, 3-satisfied, and 4- very satisfied.* Although not statistically significant, mean values revealed that faculty advising was one area that students were slightly more satisfied with and faculty instruction was one area that students were least satisfied with.

Table 1. *Mean Values for Student-Faculty Interaction*

	Mean	**Standard Deviation**	**Range**
Faculty Advising	2.71	0.849	1-4
Faculty Availability	2.69	0.719	1-4
Faculty Instruction	2.60	0.792	1-4

Means and standard deviations were also calculated on communication frequency. A higher score indicates a greater frequency of communication during office hours, during class, or outside of class and office hours. Also revealed is that on average, students reported speaking with faculty approximately 2-3 times during class, 1-2 times per month during office hours and 1-2 times per month outside class and office hours (see Table 2). The responses for student-

faculty communication frequency were assessed on a 6-point scale, with 1 being never and 6 being daily. Within this range included 4 possible responses: 1-2 times per semester, 1-2 times per month, once per week and 2-3 times per week. Therefore, the higher the mean, the more frequent the interaction. As expected, students communicated with faculty most frequently during class and least frequently outside of class and during office hours.

Table 2. *Mean Values for Student-Faculty Communication Frequency*

	Mean	**Standard Deviation**	**Range**
During Class	4.69	1.133	1-6
During Office Hours	3.38	1.178	1-6
Outside Class and Office Hours	2.94	1.405	1-6

Relationships Among Faculty-Interaction Variables

Pearson correlation coefficients were run on the all of the variables in the study to determine the presence of any significant relationships between the variables. Several relationships were found among the items used to assess faculty-interactions (see Table 3). Results demonstrate that student satisfaction with faculty availability was significantly and positively related to student satisfaction with faculty advising $r(49) = .58$, $p < .01$. The more satisfied students were with faculty availability, the more satisfied they were with faculty advising. Student satisfaction with faculty advising was also significantly and positively related to student satisfaction with faculty instruction $r(49) = .33$, $p < .05$. As student satisfaction with faculty advising increased, so did student satisfaction with faculty instruction. The student faculty interaction frequency outside of class and office hours was significantly and positively correlated with student satisfaction with faculty instruction $r(46) = .32$, $p < .01$, student faculty interaction frequency during class $r(49) = .38$, $p < .01$ and student faculty interaction frequency during office hours $r(49) = .53$, $p < .05$. Lastly, students' ratings of their overall satisfaction with their collegiate experience were positively and significantly related to their satisfaction with faculty instruction in the engineering program $r(49) = .29$, $p<.05$. The one factor correlated with student's overall satisfaction with their collegiate experience was their satisfaction with faculty instruction.

Table 3. *Student Faculty Interaction Satisfaction and Communication Correlations*

	1	**2**	**3**	**4**	**5**	**6**	**7**
1. Faculty Advising	-	-	-	-	-	-	-
2. Faculty Availability	.58**	-	-	-	-	-	-
3. Faculty Instruction	.33*	.15	-	-	-	-	-
4. During Class	-.12	.17	-.19	-	-	-	-
5. During Office Hours	.01	-.06	.16	.25	-	-	-
6. Outside Class and Office Hours	.074	.04	.32*	.38**	.53*	-	-
7. Overall Satisfaction with Collegiate Experience	.13	.05	.29*	.03	.03	.08	-

*p< 0.05. **p< 0.01.

Qualitative Analysis: Semi-Structured Interviews

Analysis Procedures

To begin the qualitative analysis of the semi-structured interviews each one of three researchers was assigned to read two interview transcripts to gain familiarity with the data and to develop emerging themes. Next, researchers then created notes in which a list of themes emerged. Through a series of meetings, themes were sorted according to topic areas. Similar themes were eventually merged together into an overarching theme. This resulted in 21 overarching themes used to code the interview data using Nvivo 9 software. To establish inter rater reliability, approximately 5 transcripts were randomly selected and coded by all researchers. Following this, the researchers discussed themes that arose and compared themes coded. Researchers continued discussions until a consensus was reached on all themes of the coded transcripts. Relevant to the current research, three primary themes emerged: peer support, classroom culture and faculty/mentor support.

Of the three dominant themes that emerged from the interview data, the theme that student's reported as having an immense effect on their persistence was peer support. Within peer support, students' language demonstrated a premium placed on support provided by both faculty and student peer groups. The data indicate that through peer networks, much of a student's academic life is experienced as a family, which provides them with support, encouragement, motivation, guidance and assistance. Classroom culture was one theme in which students described professors providing them with tools that they needed to gain knowledge and engaging students through real-life experiences and classroom interaction. Additionally, learning goals were effectively communicated to students through the expectations of professors. Student's reported faculty support through the sharing of personal life-experiences, as well as, through high expectations set for their pupils. Lastly, hindrances to the persistence of the bachelor's degree included course difficulty and individual professors with undesirable teaching styles.

Peer Support

Within the learning environment, the one factor overwhelmingly depicted by students to have a significant influence on their persistence was the premium placed on peer support; by faculty within the engineering department and among students themselves.

[Jack]:
"I know everybody in the engineering building… We're encouraged to know each other. We're encouraged to study together; go to each other for help. We have groups, teams. We're always around each other and lifting each other up so we're encouraged to be around each other."

[Amad]:
"Well, in Dr. [X]'s class, he always has us get a partner. It's not mandatory but he wants us to have a partner to do homework with and we just hand him one assignment… And that seems to work because that way, I'm just not by myself trying to figure out something. I have somebody to bounce ideas off of."

[Christopher]:
"When you're around people that have the same goals, you have the same mindset as you, it's a lot easier... So that's basically what keeps me going. It helps me to be persistent because we keep each other from being down, like, oh I failed the test…"

[Devin]:
"We have to study together. We have to do homework together. We have to do projects together. I mean, honestly, without your classmates, either you're a genius or you're prone to fail."

[Joe]:
"We work together… We pick each other up in times [when] we need each other's help. The only way that we are on the same level now and we all continue to push on together, so that we can keep going, so we graduate on time and stuff like that is by working together. So that's basically what we do."

Classroom Culture
Two sub-themes emerged from the theme classroom culture when students described factors within their learning environment: strategies and goals. For example, students described one strategy that included professors providing students with the necessary tools to gain knowledge. Also, students repeatedly described the goals set in their engineering classrooms. Professors effectively communicate these learning goals to students by setting high expectations.

[Samuel]:
"Well, the teachers give us resources and then they expect us to go out and get the knowledge… If [the student] has any problems then [the student] can come back to [the professor]… So if you didn't go out and get the knowledge… you have a problem."

Through utilizing real-life experiences and promoting classroom interaction through questions, students described engagement in problem solving and critical thinking in the learning environment:

[Jeffrey]:
"They try to make it into real life experiences because engineering is a tough field and sometimes getting the bigger picture is kind of hard so they try to bring real-life experience into it so you … can figure out different problems and ways to learn it."

[Mark]:
"And basically, they reiterate what's in the book and they'll provide their own type of examples and so they try to get the class [to interact] about the examples. So she'll ask us about a lot of questions or wants us to give examples of things so it keeps the class engaged and helps you learn the material a little bit more…"

[Jack]:
"We're expected to know a lot of formulas which normally would be given to us when we're done with school… So we don't have a lot of open book exams, it's like really rare and that's one major reason why I think they really expect us to master the material."

"The professors want us to learn. They're always telling us, all right, I know you guys are smart and I know a lot of you guys have nice memories, but we don't just want you to memorize this stuff…. We want you to understand..."

Faculty Support

Faculty support also emerged as a major theme. One way in which student's described faculty support was through their sharing of personal experiences with students.

[Darnelle]:
"He just said all his experiences in school, how he tried from one class to another class, his performances compared to other people, how he got help from his peers, from his professors, and how engineering has taken him thus far."

In describing how faculty has provided him with support through high expectations, one student states:

[James]:
"…they have high expectations for us because they don't want to lower the expectations just because we're Black… They give us high expectations and so they make us rise above."

Regarding hindrances within the learning environment, students described course difficulty and undesirable teaching styles as their biggest barriers.

[Daryl]:
"[My] biggest barrier has been just the course load, the work that's required, math courses that's required of us."

[Christopher]:
"I'll say sometimes the professors, if they don't grade your papers right away, that can be a barrier… You see […] a bad grade but you never got to study over, now you're getting ready for the next [test]… and you never knew the grade for [the previous test]."

Discussion

There are great demands in the United States of America for a competent, more diverse, globally engaged STEM workforce, who can address the critical challenges facing our nation.[2] As a result of current demands, the disproportionately low representation of African American males in engineering disciplines presents a significant concern. In the past, multiple factors have been found to have significant effects on student persistence to the bachelor's degree. One factor that has been found to have an influence on positive educational outcomes is the learning environment in which students participate.

The current study sought to understand the perceptions of African American male students, on the classroom culture and social transactions within their engineering program. Results from the current study found that the one factor that was correlated with students' overall satisfaction with their collegiate experience was their satisfaction with faculty instruction. Therefore, student

satisfaction with instruction that is received within the classroom appeared to have had the greatest influence on students' ratings of their overall college experience. These results demonstrate the significance of classroom instruction on students' college experiences. Research by Cole[8], focusing on minority college student's experience demonstrated that one of the most significant influences towards a minority student's academic achievement is the quality of their college experience. Classroom culture within the engineering department as described by students was one where professors provided them with the tools that they need to gain knowledge and engaged students through incorporating real-life experiences and promoting classroom interaction. Also significant, was the premium placed on peer support and its perceived influence by students. Students reported their peer networks functioning as a family. These peer groups provide support, motivation, encouragement and academic assistance for one another. Without these networks, students communicate the possibility of not persisting. Contrary to the current findings, research on engineer students conducted at a PWI demonstrated that students were only connected to a few students in their program[10]. However, research focusing on classroom culture within minority populations has found communalism to be a salient theme amongst students[11]. Communalism is one of the 6 African-ethos that has been found to be salient in the lives of African Americans which places a premium on the interdependence of people. Communalism is essentially the working together of individuals, for the good of the group, versus the good of the individual[11]. Students in the current study described this phenomenon during their structured interviews. Although communalism is not a novel concept, much of its work has been focused on K-12 populations.

It is important to note some limitations of the study. Limitations included, some unclear transcriptions and a small sample size. Some of the interview audio recordings were difficult to hear. Therefore, some of the transcriptions were missing small portions of dialogue. Also, the small sample size limited the statistical analysis that the researchers were able to utilize on the quantitative (survey) data. Future studies may want to consider gaining more causal data for the relationship between student's satisfaction with classroom instruction and overall college experience, as well as, the mechanisms at work that help establish a relationship between these two variables. Additionally, it would be advantageous for future research to look at the development of these peer relations and what the institution/departments may be able to do to foster healthy peer relations that may in turn lead to greater retention of minority engineers.

Conclusion

The results of this study demonstrate the importance of particular factors within the learning environment that are highly influential, particularly to African American students. The positive, significant perceived influence of peer networks on students' academic strivings is most salient in the current study. The higher rates of African American student enrollment in HBCUS have created an environment that allows students' of similar cultures to easily develop social and educational networks. This research may not only have implications for HBCUs, but for all institutions educating minority engineers. A premium needs to be placed on the formation of peer groups. Although campus-wide events may be initiated with a similar goal in mind, engineering departments may need a way to foster this sense of community. This might be accomplished though vehicles within the classroom, through curriculum or outside the classroom

through activities aimed at building a sense of family and unity; which students perceive as an important factor within the learning environment that influences their achievement and persistence.

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