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Enhancing the Persistence and Retention Rates of the Underrepresented Minority Students in the Engineering Colleges through Strategic Interventions

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WIP: Enhancing the Persistence and Retention Rates of Underrepresented Minority Students within Engineering Colleges through Strategic Interventions

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Abstract

The retention of underrepresented minorities has been a major concern for many colleges in the United States (U.S.). A study conducted in 2020 shows that, in U.S. colleges, the gap in persistence and retention rates between minority students and Caucasian students is likely as wide as 24%. Therefore, it is necessary to strategically bridge the afore-stated gap through strategic interventions. This research proposal will begin by analyzing the first two years of engineering college students' education to identify key factors that are attritional to minority students' persistence and retention rates and will then suggest appropriate interventions that could potentially reduce the dropout rate of minority students. Inclusive in the several variable factors and indicators that will be investigated are the students' confidence and expectation levels, socio-economic backgrounds, college entrance criteria, motivation, performance in first-year engineering courses, parental education, parental attitude towards college attendance, participation in social organization on campus, and the NSSE engagement indicators. A structured questionnaire survey and interview will be administered to each student, and statistical methods will be used for the analysis of collected data and for the explanation of observed trend. Synthesis of the research findings will be used to develop early warning indicators of waning persistence and predict possible strategic interventions that may combat observed trends. The intellectual merit of this research project is that it will provide a greater understanding of the disparity between minority students and Caucasian students, as it relates to engineering colleges' dropout rates, and will help college administrators devise a comprehensive research-based plan that could enhance the persistence and retention rates of underrepresented minorities within their institutions. The broader impact of this research is three-fold: it will (1) strengthen working communities and the nation's workforce, (2) advance racial equity and justice, and (3) lead to the building of an economy for all.

Introduction

In the U.S., the social and political climate of the 1970s, including the civil rights movements, culminated in laws that have profoundly altered the landscape of education (McGuire, 2007). In the 1970s and 1980s, Federal and State legislations were directed towards reducing barriers of access to higher education for underrepresented minorities, which resulted in significant improvements that provided minorities access to colleges and universities. However, enacted legislations did not address the persistence and retention rates of underrepresented minority students in colleges and universities. Generally, low persistence and retention rates are a major concern for many higher education institutions and is applicable to the general student population. For example, Cabrera (2002) remarked, "For the past hundred years, institutional graduation rate has stubbornly held at fifty percent mark: half of all students entering higher education fail to realize their dreams and aspirations of earning a certificate or degree." In addition, Tinto (1993) also opined: "The consequences of this massive and continuing exodus from higher education are not trivial, either for the individuals who leave or for their institutions." Nevertheless, the persistence and retention rates are much lower for underrepresented minorities. For example, in 2020, the National Student Clearinghouse (NSC) reported that the persistence and retention rates of Black, Latinx, and Native American students were 75.3% and 64.7%, 79.3% and 70.6%, 62.6% and 53.8%, respectively, when compared with those of white students (86.4% and 76.8% respectively). The significant disparity in persistence and retention rates between minority and white students is a major cause of concern and this project endeavors to investigate the causes of low persistence and retention rates among minority students admitted into engineering colleges in the U.S.

A Brief History of the Development of the Models of the Undergraduate Dropout Process

Before 1970, the student attrition phenomenon was often explained in terms of the students' characteristics, personal attributes, and shortcomings (Tinto, 1993, 2006 and Berger et al. 2012). According to Berger et al. 2012, the conclusion derived from previous studies "had been grounded in psychology rather than sociology." Berger further states that by 1970, the first sociological student retention model had begun largely with William's (1971) work titled "Dropouts from Higher Education: An Interdisciplinary Review and Synthesis." In developing a sociological student retention model, Spady (1970, 1971) theorized that there are two systems in each college

(academic and social) and at least two factors in each system (grades and intellectual development in the academic system and normative congruence and friendship support in the social system) that influence a student's decision to withdraw. Since Spady, several student retention models have been developed, including Tinto's Institutional Departure Model (1975, 1993) shown in Fig. 3.

Spady's Theoretical and Empirical Models of the Undergraduate Dropout Process

Spady (1970, 1971) proposed a model of the undergraduate dropout process based on the sociological concept developed by Emile Durkheim (1951), with the assumptions outlined in Fig. 2 and Fig. 3. In the model, student attrition rates were tied to several variables including family background that would influence the academic potential of the individual and their normative congruence. Normative congruence relates to a student's orientation towards the goal of graduation. Academic potential influences both the student's intellectual development and their academic performance. The model concludes that normative congruence, intellectual development, and academic potential, coupled with the support of friends would influence the social integration of the undergraduate – his/her identification with the academic environment – including the relationship with the faculty and staff of the institution. Social integration would be fundamental in determining the level of satisfaction of the undergraduate, which in turn would influence the commitment of the individual to the institution. The lower the commitment of the undergraduate student to the institution, the higher his/her tendency to drop out of the academic program would be.

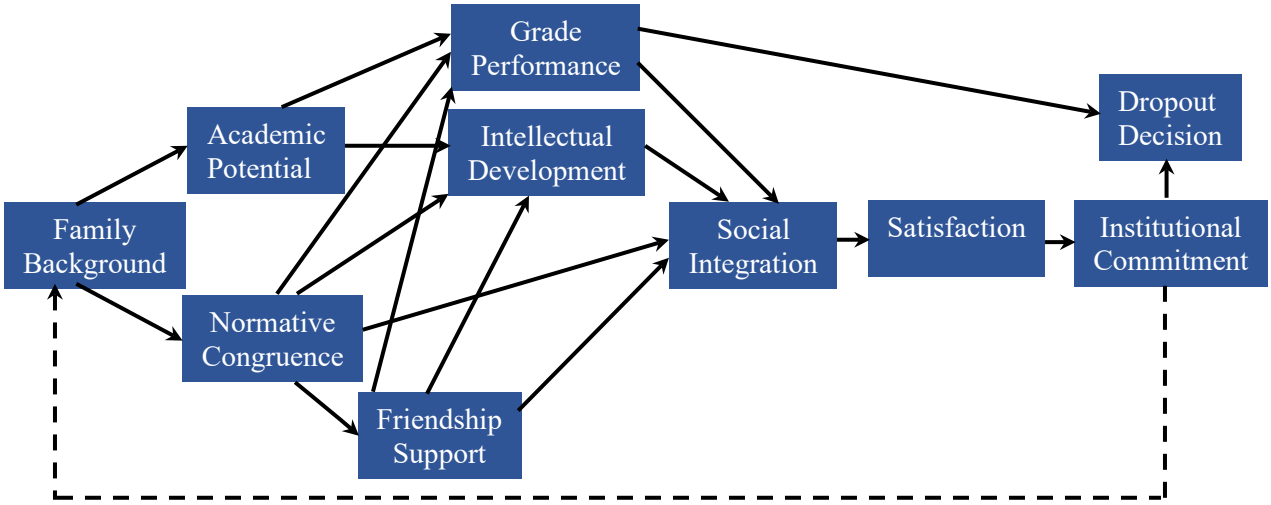

Fig. 1. Spady's theoretically based model of the undergraduate dropout process (1970)

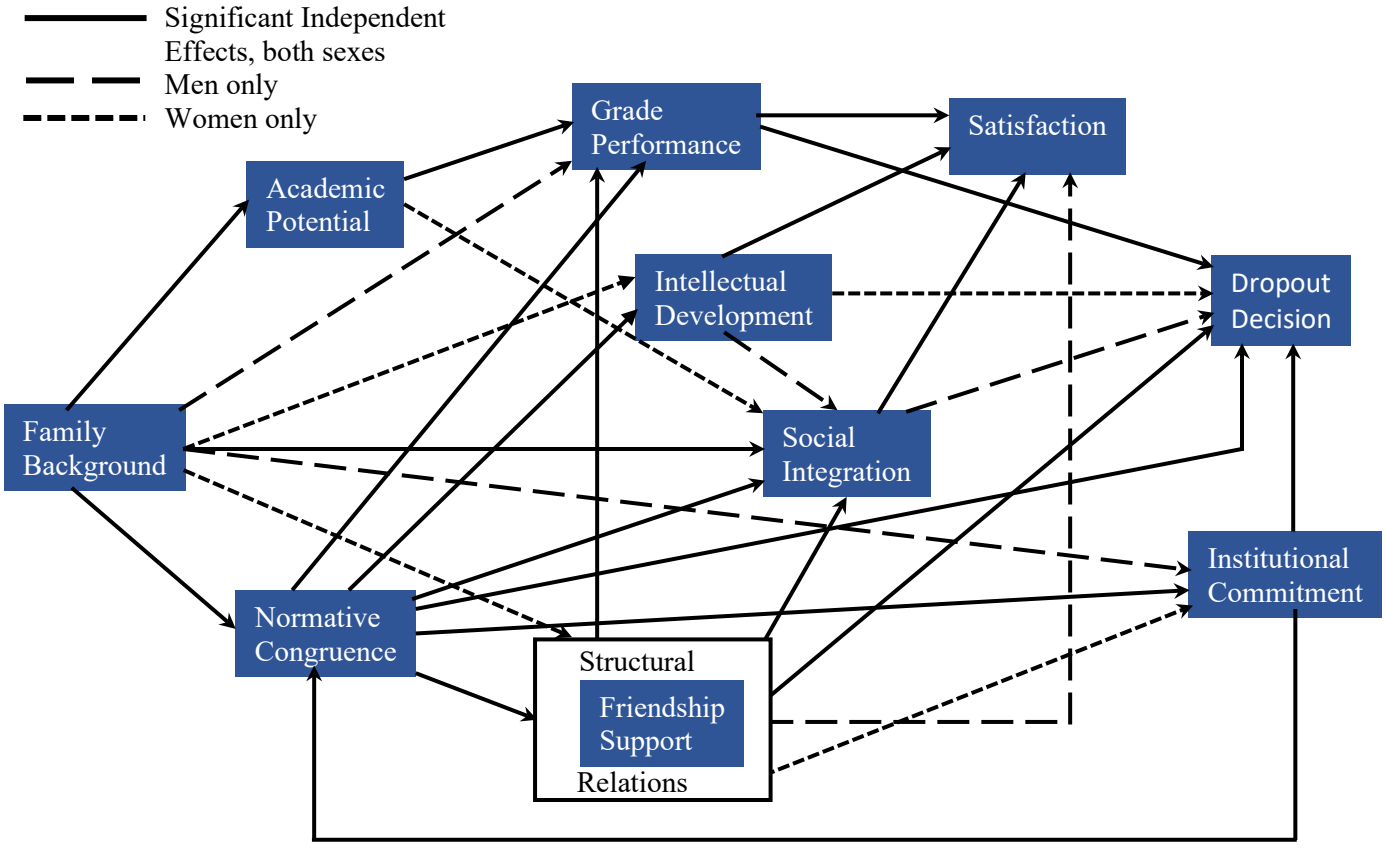

Fig. 2. Spady's empirical model of the undergraduate dropout process (1971)

Tinto's Institutional Departure Model

Tinto, building on Spady's theoretical views on the undergraduate dropout process, published the first version of the Institutional Departure Model, also known as Student Integration Model, in 1975. Between 1975 and 1993, this original model went through several revisions and resulted in the final modified version presented in Fig. 3. This final version of Tinto's model states that college consists of two systems: academic and social. Students need to be integrated into both systems to persist in their academic institutions. Academic integration can be measured by students' grade performance and intellectual development, while social integration is measured by students' interaction with college society (peers and faculty). The model suggests that when entering college, a student's initial goal and commitment is influenced by their pre-entry attributes, including their interest, skills, abilities, family background, and pre-entry qualifications.

According to the model, as students continue through college, their academic and social integration experiences will continuously strengthen or weaken their initial goals and commitments and ultimately lead to the final decision on whether to stay or leave the institution.

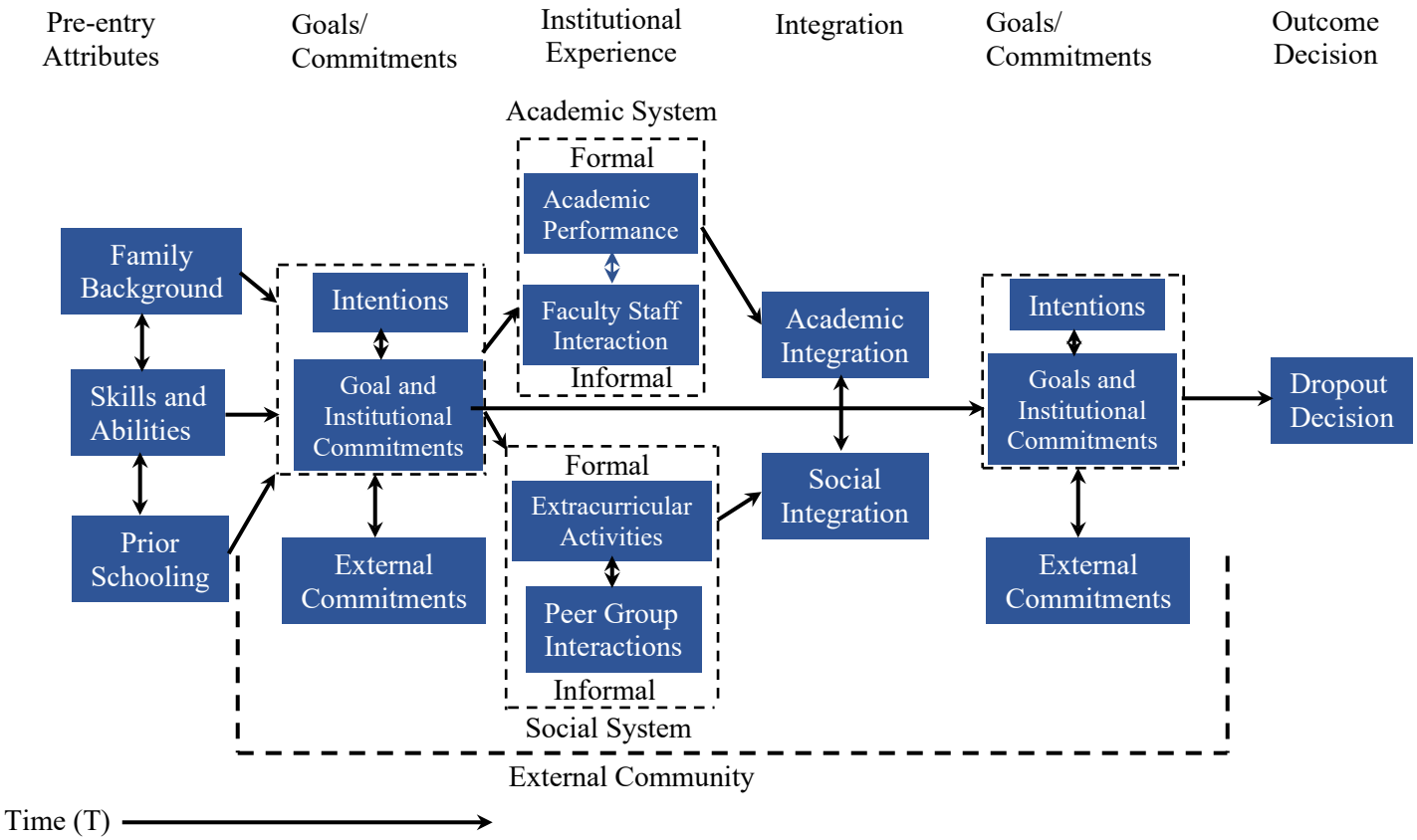

Fig. 3. Tinto's conceptual model for dropout from college (1975)

Research Methodology

Thirty underrepresented minority students from two- and four-year colleges in Pennsylvania will be recruited for the study. The colleges are Temple University, Penn State University, University of Pennsylvania, Philadelphia Community College, and Delaware Community College. The research design will be correlational, using regression analysis. The study will use the National Survey of Students Engagement (NSSE) indicators and other factors that could influence persistence and retention rates in colleges reported by past researchers as the predictor variables. The NSSE indicators include the following: higher-order learning; reflective and integrative

learning; learning strategies; quantitative reasoning; collaborative learning; discussions with diverse others; student-faculty interaction; effective teaching practices; quality interactions; and supportive environments. The definition of these predictors is presented in Table 1. Other factors that will be included as variables in the study are the pre-college preparedness of the students, such as the raw ACT and SAT scores of participants, and the socio-economic status of participants upon entering engineering college. The socio-economic status by proxy will be measured by the participant parents' levels of education. Four success workshops will be conducted at the start of each semester of the four-semester study, whereby participants will be taught several study methods and exam preparation and professional development strategies for success in engineering colleges. As motivation, each participant will be given a stipend of $1,000 per year for the study.

Quantitative Research

Research question: How accurately can the NSSE indicators and other factors that will be considered in this study predict the persistent and retention rate of underrepresented minorities in engineering colleges?

Hypotheses:

1. H_0: There is no relationship between the rates of persistence and retention of underrepresented minorities in engineering college and the NSSE indicators and other predictor variables that will be investigated.

2. H_0: There is no relationship between the rates of persistence and retention of underrepresented minorities in engineering college and the pre-college preparedness of students.

3. H_0: There is no relationship between the rates of persistence and retention of underrepresented minorities in engineering college and the socio-economic status of students.

4. H_0: There is no relationship between the rates of persistence and retention of underrepresented minorities in engineering college and the student's confidence and expectation levels.

5. H_0: There is no relationship between the rates of persistence and retention of underrepresented minorities in engineering college and the student's pre-college performance (ACT and SAT scores, high school GPA), and their first-year engineering courses performance (college GPA).

6. H_0: There is no relationship between the rates of persistence and retention of underrepresented minorities in engineering college and the parental attitude towards class attendance.

7. H_0: There is no relationship between the rates of persistence and retention of underrepresented minorities in engineering college and the student's participation in social organizations on campus.

Table 1. Definition of Engagement Indicators (From National Survey of Student Engagement, 2018b)

Predictor variables	Definition
Higher-order learning	How much students' coursework emphasizes challenging cognitive tasks such as application, analysis, judgement and synthesis.
Reflective and integrative learning	How motivated students are to make connection between their learning and the world around them, reexamining their own beliefs and considering issues and ideas from others' perspectives.
Learning strategies	Actively engaging with and analyzing course material rather than approaching learning as absorption
Quantitative reasoning	The ability to use and understand numerical and statistical information in everyday life.
Collaborative learning	Collaborating with peers in solving problems or mastering difficult materials deepens understanding and prepares student to deal with the messy, unscripted problems they encounter during and after college.
Discussions with diverse others	Interaction across difference, both inside and outside classroom, confer educational benefits and prepare students for personal civic participation in a diverse and interdependent world.
Student-faculty interactions	Through their formal and informal roles as teachers, advisors, and mentors, faculty members model intellectual work, promote mastery of knowledge, and skills, and help students make connections between their studies and their future plans.
Effective teaching practices	Organized instruction, clear explanations, illustrative examples, and effective feedback on student work all represent aspects of teaching effectiveness that promote student comprehension and learning.
Quality interactions	Positive interpersonal relations that promote student learning and success.
Supportive environments	Students' perception of how much an institution emphasizes services and activities that support their learning and development.

Qualitative Research

The steps for the qualitative research aspect of my work are as follows:

1. Identify and define the qualitative research questions. These questions would complement the quantitative research questions and provide additional insight into the study.

2. Choose my qualitative research method. This will include semi-structured interviews and survey of participants.

3. Develop qualitative research instruments. This will include creating interview questions, discussion topics, or survey questions.

4. Develop a coding scheme based on the research questions

5. Code the interview transcripts using coding scheme

5. Analyze the coded qualitative research data by identifying the frequency of each code and comparing frequencies across participants.

6. Integrate the qualitative findings with the quantitative data to gain a more in-depth understanding of the factors that contribute to the minority students' persistence and retention in engineering colleges.

7. Interpret the findings and draw conclusions. Using the qualitative findings to support and expand upon the quantitative findings will immeasurably help in the development of more effective strategies to support the minority students' success.

Participants and setting:

All archival data and NSSE record completed by freshmen minority students in participating universities within the two years of the study will be considered for the investigation. Well-structured questionnaire containing possible factors that could erode the minority students' persistence and ultimately result in their decision to leave college will be administered to students in the two years of the research. The "persistence rate" will be measured by the percentage of first-time entering students who return to college at any institution for their second year, while the "retention rate" will be measured by the percentage of entering students who return to the same institution for their second year.

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