Leveraging Lived Experiences of Nontraditional Engineering Students: Preliminary Data and Analysis

Dr. Ean H. Ng, Oregon State University

Ean H. Ng is an assistant professor at Oregon State University. She received her Ph.D. in Systems and Engineering Management from Texas Tech University. Her research interests include engineering economic analysis, high reliability organization, safety engineering, peer effects in workplace safety, and performance measurement.

Dr. Ganapathy S. Natarajan, University of Wisconsin, Platteville

Ganapathy Natarajan, Ph.D., CPEM is an Associate Professor in Industrial Engineering at University of Wisconsin – Platteville. He received his Ph.D. in Systems and Engineering Management from Texas Tech University. Gana's research interests are in engineering education, learning analytics, and novel use of data analytics in decision making.

Ingrid Scheel, Oregon State University

Ingrid Scheel is a Project Instructor at Oregon State University. She emphasizes diversity, equity, inclusion, and belonging in her courses. Scheel volunteers for organizations including but not limited to: ChickTech, Tech Trek, Willamette Innovator's Network, InnovationX, Redefining Women in Tech, and the Society of Women Engineers. She is the past president of Optica, Columbia Section, and contributes to the International Society for Optics and Photonics as a committee member, reviewer, and author. Scheel co-chairs the Effective and Inclusive Teaching Practices committee in the School of Electrical Engineering and Computer Science. Her industry experience includes prototype development, test article instrumentation, data acquisition, data analysis, and reporting.

Chukwudiebube Atagbuzia, Oregon State University
Nathan Mast, University of Wisconsin, Platteville

Leveraging Lived Experiences of Non-Traditional Engineering Students: Preliminary Data and Analysis

This work-in-progress paper presents the preliminary results from the interviews with NTES.

The population of nontraditional engineering students (NTES) is increasing across campuses as more students are returning from the workforce to complete their education and students who need to take on part-time or full-time jobs to support their education. Nontraditional students (NTS) are defined as students who satisfy at least one of the seven criteria provided by the National Center for Education Statistics (NCES) or are older than 24 years of age in an undergraduate program.

Research into NTES generally focused on their demographics, the challenges they faced and educational outcomes, and specific methods of teaching NTES. Existing studies on NTES focus on NTES' deficiencies and methods to improve the outcomes of NTES in engineering programs. None of the existing studies in NTES are asset-based that focus on their strengths such as their lived experiences or leveraging their strengths to increase engaged student learning for all students.

The objective of this study is to identify the characteristics of NTES lived experience that can be incorporated into engineering classrooms to increase engagement for all students. Interviews with NTES were conducted to identify the characteristics of NTES past experience that were of interest to traditional engineering students in their engineering courses and classrooms. Interviews were transcribed and coded for analysis.

Introduction

Non-traditional students (NTS) are defined as college students who possess any of the following seven characteristics: delayed enrollment into college, part-time enrollment, financial independence, full-time employment while enrolled in college, have dependents, is a single parent, and/or did not receive a standard high school diploma [1][2]. NCES also includes students over the age of 24 as one of the characteristics of NTS [2].

NTS population is increasing as students are attending college on a part-time basis and are taking up part-time or full-time jobs. From 2010 to 2017, part-time student attendance increased from 37.7% to 38.9%, and a projected 39.6% growth by 2028 [3]. In 2020, 40% of undergraduate students who were attending college on a full-time basis were also employed full-time, indicating a considerable NTS population [4].

NTS make up over 50% of the undergraduate student population in the US [4]. However, NTS attrition rates are higher than traditional students' attrition rates [2][5]. While organizations and governments have developed measures to manage college completion and attrition rates, the developed measures mostly favor traditional students and are less effective for managing NTS completion and attrition rates, since the constructs are not generalizable to the NTS context [6][7]. In engineering-related fields, only 16% of NTS that transferred into engineering graduated with a degree, while 32% of traditional students graduated with a degree [8].

Literature Review

Existing studies on NTS mainly focus on factors that lead to various NTS outcomes such as persistence, completion, attrition, and retention, as well as methods to improve NTS outcomes. Several studies focus on the pedagogy of NTS [26], [27].

Factors affecting NTS persistence, completion, attrition, or retention

Existing studies have identified factors that affect NTS persistence, completion, attrition, or retention, that may be categorized as social factors, academic performance factors, demographic factors, inter-role conflicts, and academic and social integration.

Social factors refer to emotional and behavioral influences from another person including but not limited to family members, classmates, and friends. Social factors affect NTS retention by influencing NTS self-efficacy and motivation in completing college [11]. As support or encouragement increases, student's perception of their abilities and determination to improve their abilities increase [11], [12]

The impact of academic performance on non-traditional students' attrition is inconsistent as some researchers have found positive associations with academic performance and persistence [13] – [15] and others have not [16], [17]. Academic performance can serve as a motivation for NTS to persist in college as non-traditional student's persistence and attrition rate by serving as a motivation to desire to persist [15].

Demographic factors such as socio-economic background and gender have been shown to have an association with NTS persistence [13]. Students who come from privileged socio-economic backgrounds have higher completion rates as they are more likely to possess the necessary

resources to complete their degrees [13]. Studies on gender effects have shown that males are more likely to drop out than females [7], [13]

Inter-role conflict: Inter-role conflict refers to when an individual struggle with having two or more roles that cause contradictions in responsibility [18]. NTS experiences four types of inter-role conflict related to family, work, and school: family-school (family demands contradicting school demands), school-family (school demands contradicting family demands), work-school (work demands contradicting school demands), and schoolwork (school demands contradicting work demands) [19]. For example, NTS who are mothers experiences role conflicts due to the internalization of intense motherhood and student roles [16].

Academic and social integration: Academic and social integration refers to the extent and quality of students' integration with the school's academic and social systems respectively. The impact of academic performance on non-traditional students' attrition is inconsistent as studies have shown a positive association between academic and social integration and persistence [6][20], while some others have not found any effect [15]. Social integration functions by creating an environment to which an NTS will want to belong to thereby creating an identity with the school and motivating them to persist [21].

Methods to improve NTS outcomes

The major support factors that improve NTS outcomes, based on literature, are social supports, academic supports, financial supports, and situational supports.

Social support refers to the provision of emotional and behavioral resources to students. Social support increases persistence by fostering integration with the school's social system, thus motivating the student to persist [21]. Social support can be fostered through co-curricular activities [22], fostering strong tutor-student relationships [22], and creating other activities that may foster student engagement and belongingness, e.g. collaborative group work [23], social programs [10], small group tutorials [9]

Since students are motivated to persist by good performances, institutions can provide systems that aid in fostering student effective learning and good performance. Academic support can be fostered through developing engaging teaching and learning programs [24], and creating easy access to school and school materials [22]

Financial support increases persistence by equipping students with the financial resources that they need to complete their classes and programs [17]. Financial support also increases persistence by reducing the burdens and cognitive stress associated with attending college, thus allowing students to attribute more cognitive load to improving their academic performance and school integration [25]. Financial support can be provided through financial aids or grants [25].

Situational support includes supportive measures that aim at reducing the inter-role conflict that NTS experiences. Examples of situational support include flexible class and program scheduling [16], [18] and counseling services [18].

Gap in literature

Existing studies on NTS mainly focus on NTS deficiencies as compared to traditional students, and focus on methods to bridge the deficiencies to improve NTS outcomes. We did not find any study that examined NTES from an asset-based education perspective by leveraging NTES lived experience to increase engaged student learning.

Methodology

To leverage NTES lived experiences in classroom teaching, our overall approach consists of two sets of qualitative studies: (1) interview with NTES to identify the attributes of their lived experiences that are of interest to their peers, and (2) interview with traditional engineering students to verify that the attributes of NTES lived experience are of interest. The target sample size is 15 students per study. This work-in-progress paper will present the preliminary results from the first qualitative study with NTES. This section will describe the recruitment process, interview process, and preliminary theme identification process.

NTES Characteristics

The NCES' seven criteria to identify NTS include criteria that some students might not be comfortable sharing. Therefore, for this study, we define an NTES as one who has any of the following characteristics:

- Delays enrollment (does not enter postsecondary education in the same calendar year that they finished high school)
- Attends part-time for at least part of the academic year
- Works full-time (35 hours or more per week) while enrolled part-time or full-time

Recruitment

Students were recruited from all the engineering programs, concentrating on students taking junior and senior-level courses such that we can capture extended experiences related to their time in their current major of study. Recruitment was done through a Qualtrics pre-screening survey in Fall 2023 that:

- Checked that the potential participants were 18 years or older.
- Checked if the potential participants worked full-time (35 hours or more) while enrolled in college
- Checked if the potential participants were a part-time student (Less than 12 semester credits or less than 9 quarter credits)
- Checked if there was a gap between graduating high school or completing a GED and starting their current degree program – if yes, we asked if they worked full-time, worked part-time, served in the military, or did something else during the gap.
- Collected potential participant's major and the level of courses they are currently taking (to determine junior/senior standing).
- Collected Names and Emails such that they may be contacted after screening.

After collecting the responses from all potential participants, those who fit the NTES criteria and were willing to provide their time for this study were invited for the interview. Those who are not NTES from the screening are a potential pool of traditional students, that may be recruited for the next stage of this project.

Interview Process

Interviews were conducted in a semi-structured manner, where some questions were prepared to lead the discussions. These questions were shared with the participants before the interview session so that they come prepared and do not have to spend a lot of time thinking of specific examples and experiences. The questions guided the NTES by asking about their experiences in their current program, positive and negative experiences when they bring up their lived experiences, the difference they notice between them and traditional students, positive and negative experiences while interacting with other students, how their experiences have helped shape how they approach their current program of study, how their non-traditional status is discussed or perceived when working in groups, and if they are comfortable sharing their non-traditional status.

The interview process was as follows:

- NTES is provided the informed consent form that explains the purpose, risks, and privacy.
- If the participant is willing and signs the consent form, the interview is started.
- The NTES screening questions were asked again to make sure that the participant still fits the NTES definition. The interview may be stopped here if the student made a mistake on the screening survey and is not an NTES.
- The interview is recorded with the consent of the NTES.
- Upon completion of the interview,
    - A post-interview information with campus resources and counseling services was provided as the interview asked about past and negative experiences that may affect the mental state of the participant.
    - A $25 gift card was provided to the NTES.

As of the preparation of this manuscript, ten interviews were conducted. An additional five interviews had been scheduled for NTES.

Codebook creation: Preliminary theme identification

The recordings from the interviews will be transcribed professionally for coding. An autogenerated transcript from the interview recording is available and is used for the preliminary theme identification to create the codebook. A codebook is a compilation of the analysis unit (themes) pertaining to this research that includes the definition, inclusion and exclusion criteria, and an example of the excerpt; the codebook can be updated when new analysis units (themes) are identified during the coding process. As the coding process is subjective, and each coder could be identifying the same themes but name them differently, the codebook will serve as a guide for the coders when coding all the interview transcripts to standardize the coding process. This standardization is intended to minimize the need to review and standardize the code later on in the coding process. Three out of the ten completed interview autogenerated transcripts were selected randomly to create the initial codebook. The creation of the initial codebook was conducted as follow:

- Independently, one undergraduate assistant and one faculty member review all three autogenerated transcripts to identify common themes across the three interviews.

- The themes identified by both researchers are then compared, and through discussion, an initial list of themes will be identified for the coding process using the professionally transcribed interview. This step is yet to be completed.

Preliminary Themes

This section provides an overview of the preliminary themes identified from the transcribed interviews. The major thematic areas pertained to the sharing of NTES status, collaboration with peers, and additional skillset gained through NTES experiences.

Sharing of their NTES status: The first thematic area corresponds to the willingness and mode in which a non-traditional student's NTES status comes up in conversations during collaborations. Under this theme some of the observations made were that: NTES were initially hesitant to share their non-traditional status, but in the right environment, they will share the NTES status. This sharing seems to benefit themselves and other traditional students in team work. NTES understand that their NTES status might come up in conversation but do not voluntarily share the information unless the situation requires them to share.

Collaboration with peers: The second thematic area related to collaboration with peers. The experiences working in industry provides NTES the knowledge to do well in engineering courses as well as be a resource for peers. In terms of collaboration both formal and informal collaborations were discussed. The overall take-away here is that NTES through virtue of their experiences are resources for their peers and can provide input on applicability or real work experiences and make the course material more relatable to traditional students.

Additional skillset gained: The third thematic area related to the NTES skillset. NTES predominantly expressed their ability to manage time and communicate better due to their experiences. Their ability to ask questions with a practical frame of reference helped further class discussions.

Selected quotes from the interviews are presented here to provide some perspective to the readers. The following two quotes were for a question asking what an NTES would tell a traditional student, based on their own experience, as an important thing to learn or remember:

- *"I would probably say, the biggest thing is that you have to like learning because engineering, you will never stop doing that, even out of school.*"
- *"Go out and actually experience. Get some experience doing the thing you want to go to school for, and then go to school for it."*

The following quote was in response to being asked about positive interactions with other students when sharing experiences as an NTES:

- *"Usually it's a very interesting topic of conversation for a lot of people actually like to hear about experiences of people who actually had those experiences*."

Overall, the preliminary themes that evolved from the initial exercise point towards lived experiences of NTES that stem from work experience and ability/willingness to share their NTES status and personal experiences with traditional students. There are indications that the lived

experiences may be leveraged to encourage class discussions and in presenting real-world applications of theoretical concepts learned in engineering classrooms.

Future Work

As this is a work-in-progress, five additional NTES interviews are scheduled as of the time of writing this manuscript. These five NTES interviews will be completed, and all the interviews will be professionally transcribed.

Codebook creation and coding of NTES interviews

Based on the identified preliminary themes a codebook will be created. Each theme will have a unique code, a definition, exemplars, and distractors defined. Each of the interviews will be coded by two different coders with a goal of an interrater reliability of at least 80%. During the coding process, if a new theme is identified, the codebook will be revised to include the new theme and recode if necessary. Once we have completed the coding of 15 interviews, if we identified additional themes, we will recruit additional subjects at the increment of five until we get to the saturation point, that is, no additional themes are identified.

Interview with traditional engineering students for verifications

Once we have identified the attributes and themes of NTES lived experience, it is necessary to examine these attributes and themes from the perspectives of traditional engineering students to identify themes that are of interest to traditional students and thus increase engagement in classrooms. A semi-structured interview process and coding similar to the one done with NTES will be conducted with traditional students.

Finalize attributes and Leveraging NTES lived experience

Using the results from both sets of interviews with NTES and traditional engineering students, we will finalize the attributes that both sets of students deemed of interest to them. The approach we plan to leverage NTES lived experience is through the creation of a set of in-class cooperative learning activities as a proof of concept, then, developing the methodology to create such activities focusing on NTES lived experience that other instructors could use to develop cooperative learning activities catered to their subject matter. The attributes identified will serve as the foundation for the creation of in-class cooperative learning activities. The goal is to increase students' engagement with the course content in-class by incorporating NTES lived experience, as NTES lived experience added another dimension to in-class teaching.

Improve engaged student learning in class:

To assess the change in student engagement during class, we will adapt the existing CLASSE survey to measure student engagement at the class meeting level. Existing CLASSE survey was developed for term-long measurement of student engagement, our adapted CLASSE survey will focus on class meeting level such that we can measure the change in student engagement when we implement the in-class cooperative learning activities that we developed that leverage NTES lived experience. For validation of the CLASSE survey we developed, we will use minute paper with rich text data for validation.

References

[1] L. J. Horn and C. D. Carroll, "Nontraditional Undergraduates: Trends in Enrollment from 1986 to 1992 and Persistence and Attainment among 1989-90 Beginning Postsecondary Students. Postsecondary Education Descriptive Analysis Reports. Statistical Analysis Report," U, Nov. 1996. Available: https://eric.ed.gov/?id=ED402857

[2] National Center for Education Statistics (NCES). Nontraditional undergraduates Definitions and Data. 2018. From https://nces.ed.gov/pubs/web/97578e.asp

[3] National Center for Education Statistics. Postsecondary Outcomes for Nontraditional and Traditional Undergraduate Students. Condition of Education. U.S. Department of Education, Institute of Education Sciences. 2023. Retrieved Jan, 2024, from https://nces.ed.gov/programs/coe/indicator/ctu.

[4] National Center for Education Statistics. Demographic and Enrollment Characteristics of Nontraditional Undergraduates: 2011–12. Sept, 2015. Retrieved Jan, 2024 from https://nces.ed.gov/pubs2015/2015025.pdf

[5] J. Kim, "What Do They Suffer? An Examination of Personal, Program, and Environmental Factors Impacting Nontraditional Undergraduate Students' Dropout," Journal of College Student Retention: Research, Theory & Practice, p. 15210251231210494, Nov. 2023, doi: 10.1177/15210251231210494.

[6] S. Gilardi and C. Guglielmetti, "University Life of Non-Traditional Students: Engagement Styles and Impact on Attrition," The Journal of Higher Education, vol. 82, no. 1, pp. 33–53, Jan. 2011, doi: 10.1080/00221546.2011.11779084.

[7] H. Taniguchi and G. Kaufman, "Degree Completion Among Nontraditional College Students," Social Science Quarterly, vol. 86, no. 4, pp. 912–927, 2005.

[8] J. Bushey-McNeil, M. W. Ohland, and R. A. Long, "Nontraditional Student Access and Success in Engineering," presented at the 2014 ASEE Annual Conference & Exposition, Jun. 2014, p. 24.938.1-24.938.11. Accessed: Jan. 29, 2024. [Online]. Available: https://peer.asee.org/nontraditional-student-access-and-success-in-engineering

[9] A. McCourt and C. Carr, "Improving Student Engagement and Retention Through Small Group Tutorials," Innovation in Teaching and Learning in Information and Computer Sciences, vol. 9, no. 1, pp. 61–77, Feb. 2010, doi: 10.11120/ital.2010.09010061.

[10] A. McDaniel, L. R. Halper, M. Van Jura, B. Fines, and M. S. Whittington, "Increasing Student Retention Rates Through Engagement in a Comprehensive Second-Year Program," Journal of College Student Retention: Research, Theory & Practice, p. 15210251221084622, Mar. 2022, doi: 10.1177/15210251221084622.

[11] K. S. Priode, R. B. Dail, and M. Swanson, "Nonacademic Factors That Influence Nontraditional Nursing Student Retention," Nurs Educ Perspect, vol. 41, no. 4, pp. 246–248, Jul. 2020, doi: 10.1097/01.NEP.0000000000000577.

[12] M. R. Jeffreys, "Nontraditional Students' Perceptions of Variables Influencing Retention: A Multisite Study," Nurse Educator, vol. 32, no. 4, pp. 161–167, Jul. 2007, doi: 10.1097/01.NNE.0000281086.35464.ed.

[13] J. Chen, M. B. Ziskin, and V. Torres, "An Analysis of Factors Affecting Dropout Risks of Nontraditional Students: Evidence from U.S. 4-Year Commuter Institutions," International Journal of Educational Reform, vol. 29, no. 1, pp. 38–59, Jan. 2020, doi: 10.1177/1056787919874864.

[14] K. Bai, “Academic Achievement and Retention at a Non-Traditional University: A Study of Factors that Affect College Retention,” Journal of College Orientation, Transition, and Retention, vol. 8, no. 2, Art. no. 2, Jun. 2001, doi: 10.24926/jcotr.v8i2.2525.
[15] J. P. Bean and B. S. Metzner, “A Conceptual Model of Nontraditional Undergraduate Student Attrition,” Review of Educational Research, vol. 55, no. 4, p. 485, 1985, doi: 10.2307/1170245.
[16] G. Markle, “Factors Influencing Persistence Among Nontraditional University Students,” Adult Education Quarterly, vol. 65, no. 3, pp. 267–285, Aug. 2015, doi: 10.1177/0741713615583085.
[17] M. Bergman, J. Gross, M. Berry, and B. Shuck, “If Life Happened but a Degree Didn’t: Examining Factors That Impact Adult Student Persistence,” The Journal of Continuing Higher Education, vol. 62, pp. 90–101, Jun. 2014, doi: 10.1080/07377363.2014.915445.
[18] K. M. Love, A. W. Tatman, and B. P. Chapman, “Role stress, interrole conflict, and job satisfaction among university employees: the creation and test of a model,” Journal of employment counseling, vol. 47, no. 1, Mar. 2010, doi: 10.1002/j.2161-1920.2010.tb00088.x.
[19] J. Kohler Giancola, M. J. Grawitch, and D. Borchert, “Dealing With the Stress of College: A Model for Adult Students,” Adult Education Quarterly, vol. 59, no. 3, pp. 246–263, May 2009, doi: 10.1177/0741713609331479.
[20] Md. A. Mannan, “Student attrition and academic and social integration: Application of Tinto’s model at the University of Papua New Guinea,” High Educ, vol. 53, no. 2, pp. 147–165, Feb. 2007, doi: 10.1007/s10734-005-2496-y.
[21] V. Tinto, Leaving College: Rethinking the Causes and Cures of Student Attrition. Second Edition. University of Chicago Press, 5801 South Ellis Avenue, Chicago, IL 60637. 1993.
[22] D. R. Cotton, T. Nash, and P. Kneale, “Supporting the retention of non-traditional students in Higher Education using a resilience framework,” European Educational Research Journal, vol. 16, no. 1, pp. 62–79, Jan. 2017, doi: 10.1177/1474904116652629.
[23] L. G. Wyatt, “Nontraditional Student Engagement: Increasing Adult Student Success and Retention,” The Journal of Continuing Higher Education, vol. 59, no. 1, pp. 10–20, Feb. 2011, doi: 10.1080/07377363.2011.544977.
[24] G. Crosling, M. Heagney, and L. Thomas, “Improving Student Retention in Higher Education: Improving Teaching and Learning,” Australian Universities’ Review, vol. 51, no. 2, pp. 9–18, 2009.
[25] T. D. Nguyen, J. W. Kramer, and B. J. Evans, “The Effects of Grant Aid on Student Persistence and Degree Attainment: A Systematic Review and Meta-Analysis of the Causal Evidence,” Review of Educational Research, vol. 89, no. 6, pp. 831–874, Dec. 2019, doi: 10.3102/0034654319877156.
[26] Li, C. Q. (2021). Teaching Mechatronics to Non-traditional Mechanical Engineering Students-An Adaptive Approach. International Journal of Engineering Pedagogy, 11(3).e
[27] Turner, P. E., Johnston, E., Kebritchi, M., Evans, S., & Heflich, D. A. (2018). Influence of online computer games on the academic achievement of nontraditional undergraduate students. Cogent Education, 5(1), 1437671.