New Orleans Jazzed about Engineering Education

Identifying as an Engineering Technology Graduate

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Identity of an Engineering Technology Graduate

Engineering graduates identify themselves as a person formally educated in engineering, who belongs to a group of people practicing engineering. How does the person holding an engineering technology degree career identify? The lack of differentiating research between engineering and engineering technology graduates results in less knowledge about self-identification by the engineering technology graduate. Many believe that the positions held by engineering technology graduates further define their self-identity, as they are titled either engineers or technologists.

Identity research focuses on career trajectory in the graduate student population. This focus places research in academia. Methods used to analyze early influences and their impact on a person's professional progress and identity are transferable. Therefore, using the approach taken on the graduate student population is germane to the engineering technology graduate population, regardless of their post-graduation path. For this study, the alumni office will send an e-mail to recent engineering technology graduates with a link to a survey. Identity-Trajectory theoretical framework will be used to interpret study results, focusing on questions developed using constructs in networking, intellectual pursuits, and institutional culture.

Results of the survey will provide evidence of how engineering technology graduates identify. Data derived from this survey will provide deeper understanding of engineering technology graduates' use of networks past and present. Responses to survey questions in this area will further our understanding of social networking and other networking techniques as it relates to engineering technology graduates in the work place. Graduates of engineering technology programs are dependent upon communication skills. Survey questions intended to evaluate intellectual measures will illuminate this aspect of the graduates' work life and how it affects their identity. Institutional culture is addressed by questions focused on the impact of one's environment and further analyzed for impact on identity. This work provides early information on the identity of engineering technology graduates, ultimately supporting the discovery of future paths for research in this area.

Introduction

Tonso[1] shares that learners who don't identify with engineering eventually move out of engineering. Seymour & Hewett[2] assert that identity and learning are interconnected, supporting Tonso's[1] conclusion that as an individual transforms from novice to experienced they move from peripheral involvement to identifying with a community of practice. Ultimately, over time, the individual identifies with the area in which they work. For the engineering technology graduate, this is problematic.

An engineering graduate generally finds a position with an engineering title, works with other engineers, belongs to an engineering organization, generally in a company that recognizes them as such. Engineering technology graduates do not experience this uniformity; therefore, the application of identity research directly to this population does not accurately reflect their identity. This lack of differentiation limits our knowledge of the engineering technology graduates' self-identification. Titles that the engineering technology graduate assumes upon graduation divide this population, and confuses our knowledge of career trajectories.

This study is an initial probe into the engineering technology graduate's identity. This early work will provide insight for future work in this area. In order to obtain information from engineering technology graduates, the study was distributed through the alumni office. It is thought that graduates that belong to the alumni association will be more willing to share the type of information we seek. The results of this study will provide evidence and direction to further study of this population, to gain a better understanding of the experiences, challenges, and resulting identity that these experiences create.

The data derived from this survey will provide deeper understanding of engineering technology graduate's use of networks, past and present, and the institutional culture that these graduates encounter in the workplace. This work provides early information on the identity of engineering technology graduates, ultimately supporting the discovery of future paths for research in this area.

Literature Review

Engineering technology students and graduates are a population dwarfed by engineering and other STEM fields. That creates a dichotomy in every aspect of study when examining demographics, career trajectories, and environmental effects on this population. Research often incorrectly applies findings from engineering to this unique populace.

Students enrolled in engineering technology programs are taught to apply theory to practicality. This is a contrast to engineering students, whose primary focus is theory and conceptual design.[3] Graduates of engineering technology programs, due to their knowledge of the incorporation of theory into authentic situations, pursue different employment than engineering graduates post-graduation. Applying findings from studies done on engineering students will not reflect the experiential knowledge and career trajectories that this unique body of students encounters.

Choosing to investigate engineering technology graduates is an early attempt to understand how these graduates self-identify. Ashford, et al[4] explains that identity must be understood to further define one's identity. While the methods of how to determine the identity of engineering technology graduates are plentiful, care in the choice of what to use in furthering our knowledge

in this area is imperative. After evaluating methods of understanding, those that appear to apply to engineering technology students have three different aspects. These three aspects often complement and intertwine with the others in providing a complete understanding of the population studied. In general, these three aspects consist of some sort of social networking, intellectual pursuits or role identity, and organizational environments.[4,5]

This work focuses on the engineering technology graduate and will employ the results of a survey of this population, interpreting the findings using the Identity-Trajectory theoretical framework[5,6]. The survey consists of three sections with questions developed using constructs in networking, intellectual pursuits/role identity, and institutional culture. Networking includes the social group that an individual is a part of as a child, moves into as an adult, and works with as a professional, as is the case with the engineering technology graduates. These components provide an individual value, emotional significance, and how they look at themselves as they relate to others[7,8]. The second section of the Identity-Trajectory Theory[5,6] is the least cohesive from theory to theory, ranging from consideration of intellectual artifacts to how someone identifies in their various roles. We will utilize this portion of the theory to evaluate how the engineering education technology graduates identify to their job title, and issues regarding tenure in those positions. Finally, institutional culture is consistently a consideration and intersects both of the other aspects of this theory. Albert and Whetten[9] and others[10,11] assert that individual identity is central to the cultural composition of an organization. This suggests that the individuals as they comprise the organization also reflect the combined identities of those in that organization, resulting in a corporate identity.

By combining these aspects, we observe how an individual develops through their personal interactions, things that they are doing, and those that work around them, essentially providing an amalgam of impacts, and personal characteristics resulting in individual identity.[8,12]

Methodology

A survey has been developed that uses a variety of survey tools[13-15], grounded in the referenced literature and aimed at characterizing the identity of the engineering technology graduate. The questions are referenced throughout the results section.

The survey was distributed to 4,821 email addresses identified as engineering technology graduates through the alumni association. This method of distribution was used because those graduates who belong to the alumni association are more active and perceived as more interested in future of the university. The distribution occurred on the Monday before a national holiday. Twenty-five of those email addresses bounced, 20% of the recipients opened the email, and there was a click through rate of 4.3%, which on most surveys is approximately 3%-5%[16]. Due to the timing of the first email, a second reminder email was sent to those who had not opened the

email and the increase in respondents went up by nearly 35%. The following figure shows the email total, email received total, how many of the emails were opened, and how many responded; all indicating a higher than normal response rate to a survey of this type.[17,18]

To facilitate review of the data, it was cleaned and then sorted. Many of the respondents listed degrees along with years of graduation, making data sorting and filtering difficult. The following describes the findings in the survey data, focusing on engineering technology graduates from the last five years and those that graduated 10-15 years ago. For purposes of the conference paper, we wanted to pay particular attention to the most recent graduates and those considered to be approaching their mid-career years.

Results

The survey was broken into three distinct parts: demographics, graduation/degree completion, and future thoughts. Engineering technology graduates from the years 2010-2015 and 2000-2005 were chosen for this initial examination. Those graduating most recently are more relevant to current practices in the college, while those in the later grouping are mid-career and have more experience that is relevant to the workplace. The findings in each section are in the following narrative.

Demographics

Participants completed several questions regarding their demographics. They include:

- Gender: M/F
- Age in Whole Years: 18-22, 23-30, 31-37, 38-45, 46-54, 55+
- Degree Program: MET, ECET/EET, MFT
- Where Did You Start College: Purdue Technology, Community College, Purdue Engineering
- Do you have a graduate degree? If so: Selection of degrees, year graduated
- Year You Graduated: _____
- Hometown: City, State
- Current City: City, State

Demographics – 0-5 Year Graduates

Of those graduating in the last 5 years who participated in the survey, 24 graduates responded. Of the respondents in this group, only males responded. 23 graduates were in the 23-30 year age bracket, and one was in the 31-37 year old age bracket. Of the 24 graduates, half graduated with a degree in MET and the other half in ECET/EET. None of the graduates responding to this

survey was a graduate of the MFT program. Table 1 contains the responses of graduates to the question asking where students started their studies.

Table 1. Where 0-5 Year Engineering Technology Graduates Began Their Undergraduate Studies

Purdue University – Technology	14
IUPUI General Studies	1
Purdue University - Engineering	3
Purdue University – Undergrad	1
Purdue – Calumet	2
Texas A&M	1
Ivy Tech	1
USP	1

Based upon the answers provided, it is unclear in some cases if the graduate in the first category began in Technology or came from another part of the university.

The subsequent questions ask if the student has a graduate degree. Of those responding to this question, 13 definitively said no, three said that they were currently pursuing or planned on pursuing a graduate degree (Engineering Management, Computer Science, Mechanical Engineering), and four of the graduates stated they had a master's degree (Public Administration, Systems Engineering, Electrical Technology, and Engineering Technology). One of these respondents is currently working on a PhD in a School of Planning: Urban and Regional Futures. Finally, graduates were asked what their hometown was when they began their studies, and what they considered their current hometown. Of those responding to these question, six graduates stayed in the same town they lived in upon beginning their studies, four moved within Indiana, four moved to a state surrounding Indiana, and ten moved more than one state away from Indiana.

Demographics – 10-15 Year Graduates

Of the engineering technology graduates with 10-15 years past their baccalaureate degree, 35 responded. Of the respondents in this group, there were 5 females and 30 males, with 33 between the ages of 31 and 37, one in the age group bounded by 38 and 45 years old, and one graduate who is between 46 and 54 years of age. Of the 35 graduates, 18 graduated from the MET program, 12 from ECET/EET, and the remaining 5 from MFT. Table 2 below shows where this group of students began their undergraduate studies.

Table 2. Where 10-15 Year Engineering Technology Graduates Began Their Undergraduate Studies

Purdue University – Technology[a]	21
Purdue University – Engineering	5
Purdue University – Science	2
U. of Southern Indiana	2
Purdue University – Comp. Sci.	1
Purdue University – Kokomo	1
Purdue U – SB – Gen Studies	1
Rochester Inst. Technology	1

While tabulating this data, one student did not respond, and in a few cases, it was difficult to understand if the graduate began their studies at Purdue University in technology or another major.

Graduate responses to the question regarding a graduate degree varied. Six of the graduates left no response, while 20 of the graduates indicated that they did not have a graduate degree, and one stated that they were pursuing a masters in mechanical engineering from Purdue University. Of those who hold a master's degree, two have MBA's, one an MSME, another completed a BSME and BSAvTech, while the last holds a masters and PhD in Informatics.

For the question regarding graduates hometown when they began their studies and their current hometown, six stayed in their hometown, eleven moved within their state, two moved one state away, 14 moved more than one state and in one case to another continent, and two graduates did not respond.

Graduation/Degree Completion

Engineering technology graduates were asked the following questions:

- When you graduated from Purdue's Engineering Technology program, what were the job prospects? (Great, OK, Poor, None)
- Did you feel like you were well prepared? (yes, no)
    - If not, what would you do differently?
- Did you receive enough guidance in how to look for a position?
    - If no, what would have helped you?
- Did you have any issues with your degree being from a technology program?
- Did others outside of ET understand what your degree was?
- Do you use social networking tools, if so how do you describe your profession?
- When you moved into your first position:
    - What was your title?

- Did your coworkers respect you?
- Did your superiors treat you in the same way as others?
- Was everyone that started with you compensated equitably?
- Are you still working for the same organization?
- If not, when did you leave?
- If you are, are you in the same position? Why?

Graduation/Degree Completion – 0-5 Year Graduates

Of the engineering technology graduates responding to the survey, six stated the job prospects upon graduation were excellent, seven said very good, six good, four fair, and one poor. The graduate choosing poor indicated that they chose the wrong major. The survey asks if the graduate felt well prepared for the job market and to provide a rationale for that answer. Graduates stated that they were well prepared due to the internship opportunities they had, and that broad and challenging experiences provided a solid basis on which to interact with potential employers. Three students indicating that their preparation was excellent did not substantiate their answer.

Engineering technology graduates were also queried about guidance in looking for a position upon graduation. Of the 24 graduates, 15 said yes and nine said no. The follow up question asked what would have helped them with their job search and they stated that it would have helped if they had one on one meetings, required a one credit class specifically for job search skills, required a full year senior design project of all students, and the career center is too general -- more specific information is needed, Graduates were also asked if they had any issues with the engineering technology degree vs. engineering degree. The results indicate that five of the graduates did have an issue, while 19 did not. Comments to support answers provided indicated that ET grads are hired at lower levels than their engineering counterparts, they have to work harder to show their capability, potential employers have preconceived notions that ET degrees were inferior and were at times thought to be two-year degrees or certificates. One respondent indicated that their resume presents their experience prior to their degree to deemphasize the ET degree.

Graduates were asked if others outside of engineering technology understood their degree. Sixteen indicated that it was understood, while eight did not. Half of the graduates indicated that they use social networking in their job and the other half did not. They were asked to support that answer. Thirteen graduates did not respond. Engineering technology graduates stated that they posted photos of their job, and describe it as hands on and activity driven. The majority of the responses from the graduates used engineering, not engineering technology to describe their jobs.

The transition into a first position resulted in a variety of titles. Two of the survey respondents did not provide a title, while 16 had an initial title that contained the word "engineer." Those that did not have engineer in their initial title had words such as researcher, supervisor, and technician, with two of those indicating an assistant or similar. All of the engineering technology graduates except two felt their peers respected them. Of the two who did not feel respected, one indicated that they did not have the same experience as the others. Two graduates indicated that their superiors did not treat them in the same way as other employees. One of those was the respondent who did not feel respected by peers, and the other is different from the graduate that responded to the previous question. Seven of the twenty-four graduates said that not everyone starting at the time they did were compensated equally.

The engineering technology graduates responding to this survey indicated that they were in the same organization for a variety of reasons, including: they had been with their current employer for a short time, they love their job, and there is no place to go. Others that have already transitioned indicated that there was minimal upward movement. A recruiter presented a more favorable position. Based on the responses, it appears that those who moved did so in the first two years following graduation.

Graduation/Degree Completion – 10-15 Year Graduates

Of the engineering technology, graduates with 10 – 15 years of experience post-graduation that responded to the survey indicated that the job market was only fair. Comments indicated that this group of graduates encountered the job market following the events of September 11, 2001. The difference between the 0-5 year graduates and this group follow in Figure 1 below, with the ratings of Excellent (1), Very Good (2), Good (3), Fair (4), and Poor (5) along the x-axis and no scale on the y-axis as this is for a strict comparison.

Figure 1. Contrast of Job Market 0-5 Year and 10-15 Year Post Graduation
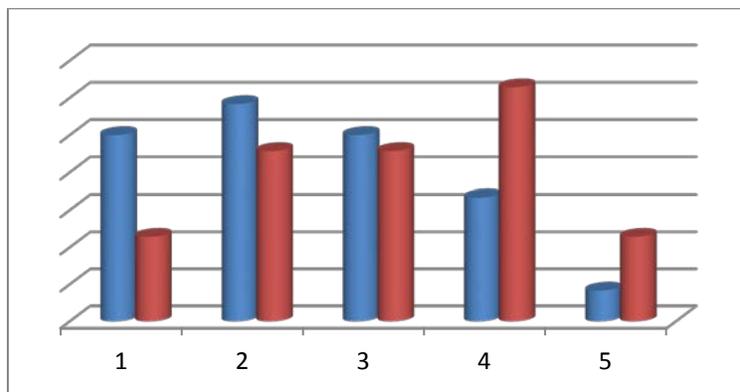
(Blue/Left – Recent Graduates, Red/Right – Later Graduates)

Engineering technology graduates indicated that they were well prepared for the job market. Comments to support that answer included: the program did a good job teaching them how to think; it enabled the students to hit the ground running; and experience from co-ops and internships gave them the opportunity to know an employer. Others indicated that the events of September 11, 2001 hurt the job market, making it difficult to find a job. In one case, where it took the respondent a few years to get a degree-related position, they felt unprepared to leverage their skills in such a depressed market, and they were unsure of how to apply their skills in the work place.

In response to a question asking what should be done to guide current and future students, a number of similarities existed. Suggestions included a required course or seminar that taught how to transition into a new job and skills that could be used in finding that job, including salary negotiation and networking. They suggested that internships and co-ops s also be mandatory, as should one-on- one counseling with a technology career counselor for every student. They also noted that guidance in the job hunt was available while they were students, but not offered post-graduation.

Ten of the engineering technology graduates stated that they had issues with potential employers because they had an engineering technology degree. The comments received in support of these answers included large corporations don't value engineering technology and engineering degrees the same; some had to explain engineering technology was a "real degree." It was noted that if they hadn't interned at the company first, the degree would have been an issue, and others, most notably engineers, tend to look down on them. When asked if others outside of engineering technology understood what the degree was, nineteen of the 35 respondents said no.

When asked about use of social networking, 19 of the engineering technology graduates indicated that they did not use any kind of social networking. Those who indicated they used social networking most said they explain their profession as engineering, and one said technology.

As these graduates moved into their first position, many had engineer in their title. Two graduates did not provide a title and others had words such as inspector, representative, coordinator, CAD detailer/drafter, associate, technician, scientist, designer, and one was a scientific glassblower. All of the respondents indicated that their coworkers respected them in their first position, while two of the graduates stated that their supervisors did not treat them the same as other employees. Seven of the graduates said that they were not compensated equitably compared to the employees starting at the same time as they did.

Eight of the graduates stated that they were at the same company they started with right after graduation. A few of the reasons they cited were upward movement in the same position, they like their coworkers and felt well compensated, they moved to another business unit, the position is challenging, and they were promoted. Those who indicated they had moved stated that they

had issues with upward mobility, found a better job elsewhere, wanted to change industries, and moved to increase their level of responsibility.

Future Thoughts

Engineering technology graduates were asked the following questions:

- Looking back to when you started in the engineering technology program, would you change your choices?
    - If yes, what would you do differently? And why?
- What are your prospects for the future?
    - Will you be promoted?
    - Will you move on to another company?

Future Thoughts – 0-5 Year Graduates

Of the responding recent engineering technology graduates, eight said they would do things differently. They noted that they would look for different ways to fund their education, possibly ROTC, or they would have taken a different engineering technology major as their interests have changed. A couple indicated they would have transferred to engineering, and they also indicated that they would have taken more classes in their area.

The last question asks about future prospects and the future plans for engineering technology graduates. Eight indicated that they anticipate promotion, 12 are considering a move, four are happy, and one respondent did not answer. In support of these answers, some have already been promoted or expect it in the next year, they want to move closer to their family, have experienced a lack of loyalty to the employee, student loans are a burden and they need more money, company is having mass layoffs, doesn't like the location, not adjusting well, compensation is an issue.

Future Thoughts – 10-15 Year Graduates

Of engineering technology graduates in this group, 14 indicated they would do something different. The supporting comments indicated that they would have changed their major, some to a different technology area, others to engineering. Some suggested that a degree in computer science would have been more helpful, or they should have improved their interviewing skills, or established a better professional network by getting to know the professors better. One said they would have stayed in engineering instead of transferring.

Finally, 12 of the graduates have been promoted, seven moved, 14 are happy with their current situation, and two did not respond. Input provided with these answers included that the graduate was moving on for family reasons, or advancement opportunities existed, or they love their current position. One said they may move if their pursuits do not go as planned, and many are very happy with their position, the company, and job responsibilities.

Discussion

In most cases, at this point, an examination of the data against current literature would be appropriate here. However, since this is intended for a conference, that type of examination will be withheld until more data is examined for another venue. To not shortchange this paper, a comparison of the age groups examined against the theoretical framework will provide us with an early impression of the identity of an engineering technology graduate.

Demographics

In review of the data, a comparison of the two groups of engineering technology graduates shows us that the early graduates were only male, while the later graduate population was 17% female. The later population reflects a higher number of female graduates but is lower than the graduates in the general population of the United States[19]. Based upon degree, the early group did not have any MFT, while 17% of the later groups were MFT graduates. By percentage, respondents from both groups began their undergraduate studies at Purdue in the School of Engineering Technology. When these students pursue a higher degree, a few went over to engineering, and others went into public administration or business. In both respondent groups for this study, a student went on to a PhD in an area different from their undergraduate degree. When reviewing hometown information, both groups moved away from Indiana at about the same rates, making note that some of the graduates were disappointed that they could not find a job in Indiana.

Graduation/Degree Completion

Figure 1 shows the difference in opinion regarding the job market. The 10-15 year graduates were heavily affected by the events on September 11, 2001[20]. The job market was not good affecting the graduates; one noted it took two years to find a job in his major.

Some graduates all said they were well prepared for the market place and suggested that a mandatory course that provided preparation for interviewing, finding a job, and had specific resources to technology provided to them would be beneficial. The early graduates had to prove their skills to overcome preconceived notions regarding their technology degrees, and all had problems with employers not wanting to consider them par to their engineering counterparts.

As for transitioning into a first position following graduation, they were distributed at the same rate in engineering vs. non-engineering titles. These graduates, in general with few exceptions, felt their peers and supervisors respected them. However, both groups indicated that compensation between those starting at the same time was not always equitable.

The graduates in both groups responded a little differently regarding the job satisfaction question. The earlier group indicated that they had not been at the job long enough or had already made one change. The latter group stated that they may have made up to 3-4 job changes, and based upon their comments were either very happy, looking for something to happen, or

contemplating a move. Reasons for moving included minimal upward movement, more favorable positions, with an indication that the more recent graduates were less satisfied than the latter group of graduates in their positions.

Future Thoughts

Both groups shared similar opinions considering the start of their undergraduate studies. Graduates stated that they may have chosen a different major, based on interests and the market place, or their choice of major may have been a different technology engineering major or engineering. Some thought taking more courses in their area would have been beneficial to them as well as better developing their professional network.

The newer graduates are still contemplating moves, and experiencing separation issues from their families. The latter group is happier, and more settled in their professional lives.

Significance of this Work

Learning more about engineering technology graduates, what they experience, and how they view their integration into the environment aids in our understanding of their identity. The first area of examination is network. While we do not have information in this study about the lives of the graduates prior to their undergraduate study, we do know where they lived, what they first studied, if they went on for further study, and where they live now. Examining the two groups, we learned that the majority of the responding graduates began at Purdue University, and the majority left their hometown and moved more than one state from where they lived when they began their undergraduate studies. Considering comments made throughout the survey, we know that many of the earlier graduates moved or are considering a move from their first job because they are not developing a satisfying network of friends and they want to live closer to their families. This provides us with information supporting that the graduates value family and friends. The latter group of graduates does not respond to the survey in the same way, however. Many of them indicated they had moved a few times for a variety of reasons.

Answers to questions on job titles, switching jobs, and issues related to the engineering technology degree provided a clearer view of how the graduate identifies in their professional role. Those involved in engineering technology understand the applied nature of engineering technology, while others outside of the field do not always grasp the difference from engineering. Responses provided regarding job titles indicates that many of the engineering technology graduates do not have engineering job titles, and do not necessarily work in engineering roles. Some find this frustrating, which is noted in their responses regarding a lack of supervisor and peer respect. Others noted that they had to work harder to prove themselves as worthy of the title as their engineering peers. The fact that the latter group of graduates have moved jobs 3-4 times in 10-15 years is concerning and needs to be investigated further. They too had concerns regarding the degree, often citing their profession to be engineering to avoid confusion with the uninformed. When queried about the future, the graduates in both groups

suggest mandatory training in job searching skills as well as skills needed in the early career. Some said they would have stayed in engineering or transferred to engineering, while others suggested that a degree in a different area would be of benefit. This information provides an early view of engineering technology graduates having to assume the engineering identity to maintain respect. They did not feel proficient in job hunting skills, and would have considered doing something different. This essentially provides a discontinuous view of these graduates when viewed through the lens of professional identity.

Finally, the institutional culture is difficult to see in this data; rather we see a group of graduates who self identifies with a variety of roles that value family and friends after being in the workplace for a short time. Based upon the comments made in the various survey questions, graduates responded that they did not trust their employer due to layoffs, previous experiences, etc. While others were very happy where they were, enjoyed their working environment, and fulfilled a variety of roles within the organization.

Conclusion

While this study did not result in a deep understanding of the engineering technology graduate, we did find that further research is warranted. Early graduates are still working on gaining employment, searching for things that interest them, and developing their networks. The graduates from a later time are more settled in all aspects of their lives, careers, and interests, providing a slightly different perspective on their identity, supporting Tonso's[1] assertion that an individual will identify with a community of practice.

Future Research

A larger survey will provide more information and a better understanding of graduates as they move through their careers. Using a group of early graduates, and those who graduated 10-15 years ago provides a better understanding of the questions that should be asked as well as how they should be phrased. This study has provided valuable insights into the aspects of engineering technology graduates lives and should be used to further develop inquiry as it relates to this population.

Future research will consist of an examination of the entire set of survey results, with the intent of determining any patterns that will provide engineering technology administrators with useful information for program improvement. That examination will provide input for improvement of the survey and solicitation to all engineering technology graduates, not just alumni association affiliated engineering technology graduates. Ultimately, the information derived from this work and future work in this area will provide a good understanding of the differences of engineering technology and engineering graduates.

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