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A qualitative single-case study exploring the impact of a mentor and cohort on students' academic and career decisions

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Abstract

Exposure to research is known to play a positive role in undergraduate education. However, robust research responsibilities are oftentimes not formally incorporated into a student's academic experience until master level studies. Further, a variety of intimidation factors often inhibit many undergraduate students from participating on a research team. In this case study, the research team evaluated a unique group of undergraduate researchers who matriculated to the same university after beginning to participate in research as concurrently enrolled students. Following matriculation, each student continued to participate in research throughout the entirety of their undergraduate studies. All of the study's students were STEM majors and undertook this research, both prior to and following matriculation, in the same lab and under the same mentor. This arrangement removed many of the common barriers to students participating in undergraduate research, such as the intimidation of working with strangers, including graduate students, and unclear expectations for undergraduate lab students from faculty. Consequently, the unique circumstance presented in this work affords the opportunity to more fully explore the influence that a strong long-term mentor and extended participation in research have on students' post-graduate decision making.

1.0 Introduction

The Gaetz Aerospace Institute (GAI) at Embry-Riddle Aeronautical University provides a concurrent enrollment model (CE) to over 85 high schools across the United States. The concurrent enrollment model offers college-credit coursework taught by college-credentialed instructors, oftentimes serving in dual roles as high school teachers on the student's high school campus (nacep.org, 2020). This latter characteristic is commonly used to differentiate the concurrent model from the dual enrollment (DE) model, where students leave their high school campus, most often undertaking coursework at their local community or state college (Witkowsky & Clayton, 2020).

Embry-Riddle, through the GAI, specifically offers science, technology, engineering, and mathematical (STEM) oriented coursework that expose students to undergraduate degrees that may appear otherwise intimidating. The coursework administered at the high school reflects the pedagogical, theoretical, and philosophical orientation of Embry-Riddle courses. Further, Embry-Riddle residential faculty provide course-specific training regarding course curriculum, pedagogy, and assessment criteria to the concurrent enrollment instructor.

One faculty member transitioned to Embry-Riddle's Daytona Beach residential campus following seven years of service with the GAI. During his tenure with GAI, the faculty member instructed a variety of concurrent enrollment courses and maintained an active research agenda that involved concurrently enrolled students. Upon matriculation to Embry-Riddle's main campus, one student enrolled in a meteorology degree program and four students undertook studies in engineering physics. Each of these students remained engaged in undergraduate research with the faculty member while he continued to serve in a strong mentoring role. This unique circumstance, with a relationship that spanned six to seven years for each student, provided an opportunity to investigate the role that substantive early exposure to rigorous academic research plays in an undergraduate student's academic experience as well as their post-graduate educational or career selection decision. Following a review of the applicable literature in section two and a specific stating of the research questions and the methodology employed in sections three and four respectively, the findings are put forth in section five. Section six acknowledges the limitations of the study prior to succinctly summarizing the conclusions and plan for future work in section seven.

2.0 Literature review

2.1 Dual/concurrent enrollment

Many students who participate in DE programs gather a sense of responsibility for their education sooner than those of their peers who enter college without a DE background (Lile et al., 2017). This reason alone is significant enough for high schools to encourage their students to enroll in dual enrollment programs. However, most of the research about the transferability of DE experience does not continue beyond the first-year experience at the undergraduate level. Relationships prove essential in STEM fields where students often feel intimidated by the content or the perception of what the content may demand of them. Being embedded into a community associated with this potentially intimidating field early on can ease the transition to studying it despite the challenges of moving away from home and entering a new environment (Tenenbaum et al., 2017). Much of this research is rooted in near peers or mentorship relationships that are less formal in nature.

Many studies previously conducted included data on first-year undergraduate performance, student perception of preparedness for college, and opportunities for first-generation college students or those from low-income economic status. These are all evaluated on an individual experience. This study, however, looks at how relationships built during students' CE experience and how this translates to decision making throughout the duration of their undergraduate studies and, later, into decisions regarding post-graduate activities.

2.2 Undergraduate research

Amaya et al. (2018) found that students who engage in undergraduate research are more engaged in their academic success and gain skills including "team ethics, problem-solving, and communication skills" which are all skills that employers, from all fields, continually use during new hires interviews (p. 2). When evaluating students' perceptions of a summer undergraduate research experience, Trott et al. (2018) found that "several participants recalled feeling more independent, self-confident, and intrinsically motivated as a result" of participation in the summer program (p. 75). This might provide an advantage to a student when applying for a position immediately following graduation. This may also serve as the "experience required" component that many companies demand, even of new graduates. These advanced skills often come from having a strong advisor who can guide students, not only in research but also in their future academic and career goals (Amaya et al., 2018; Bradley, 2013).

One comparative study, undertaken at the University of Arizona, questioned alumni of their Undergraduate Biology Research Program (UBRP) and College of Medicine (COM) 22 years following graduation regarding the impact that their undergraduate research had on their current positions. Some significant results from their survey include that "seventy-one percent of the COM respondents indicated that they had a mentor who had been an influential role model," with 66% of the UBRP respondents answering similarly (Yaffe et al., 2014, p. 29-30). Also significant, one-third of the UBRP respondents who had a negative research experience, attributed the negative experience to having a bad experience with the mentor. The interaction between the mentor and mentee in undergraduate research helps establish the culture of research within the mentee themselves. This translates into student's persistence, willingness to take on more challenging coursework, and the perception of their capabilities in research and coursework. Subsequent to this, these perceptions influence the career positions that

these students see as being achievable (Byars-Winston et al., 2015). The body of associated literature continues to solidify the idea that undergraduate research provides confidence, positive self-perception of ability, and willingness to pursue either a career in STEM or post-graduate work in STEM. These skills are not only essential to succeeding in STEM related fields but are exceptionally challenging to teach in a classroom setting (Behar-Horenstein et al., 2010).

2.3 Data analysis & theoretical framework

The data analysis for the investigation was purposefully undertaken. First, all interviews were transcribed and sent back to the participants for review and approval. After receiving the approval from the participants, the researchers read the transcriptions of the interviews individually and exercised memoing as they immersed themselves in the data. While reading through the transcripts, the researchers created notes in the margins of the data, beginning with the development of the codes and then the formation of themes from the codes. This coding strategy for its major categories of information is referred to as open coding (Creswell & Poth, 2018). Merriam (2009) suggests that assessing the codes is the initial step in categorizing and gathering meaning from the data. Furthermore, reviewing open codes and grouping similar data together into axial codes created "coding that comes from interpretation and reflection of the meaning of the data" (Merriam, 2009, p. 180).

Tinto's (1993) theory of student departure was the conceptual framework for the study. There have been five areas that Tinto (1992; 1975; 2012) has identified, as his conceptual model has evolved, that deter persistence among students in higher education: expectations, advice, support, involvement, and learning. However, the theory of student departure makes a strong argument to validate that the interactions between perceptions and behaviors of students play a key role in the integration and persistence in academic environments. Given the unique circumstances of the present study, Tinto's (1993) theory of student departure enabled the researchers to remain focused on how a faculty member's expectations, advice, support, involvement, and facilitation of learning impact students' post-graduation decision-making.

3.0 Problem statement & research questions

3.1 Problem statement

Most students find that research is intimidating due to a lack of exposure to the process and, consequently, avoid the experience altogether. Students who are introduced to research in their undergraduate studies oftentimes do not get fully immersed in the experience and, thus, the experience can be intimidating. This results in minimal participation in publishing, presenting, or otherwise (Villa et al., 2013). Currently, it is not known how early and substantive exposure to research, beginning as early as high school concurrent enrollment, influences post-graduation decision-making.

3.2 Research questions

The research question being posed to this group are:

RQ1: How does early exposure to research impact a student's decisions at the time of degree completion?

RQ2: Why are students who engage in research early in their academic career more likely to choose research-based career paths?

3.3 Phenomenon

The purpose of this qualitative case-study is to understand how early research exposure impacts undergraduate students' academic and career decisions following graduation. At this stage in the research, early exposure to research can be generally defined as the introduction to undergraduate research practices at a college freshman level or earlier. Such exposure could range from conducting literature searches to collecting data or executing the research itself.

4.0 Methodology

4.1 Participants

This case study uses the experiences of five public school students who first engaged in research as concurrently enrolled students through the GAI at Embry-Riddle Aeronautical University (see Table 1). Following completion of their high school diploma, each matriculated to Embry-Riddle Aeronautical University's Daytona Beach residential campus to earn their bachelor's degree. Four of the five participants chose a major in Engineering Physics, the fifth double majoring in Meteorology and Computational Mathematics. Three of the Engineering Physics majors also minored in various programs, including Applied Mathematics, Aviation Law, Computer Science, and Computer Engineering. Of the group of five, two participants have immediate plans to pursue a graduate-level degree, while two others are entering into industry immediately after graduation. The final participant intends to pursue a graduate degree following one year of full-time employment in a Federal Work-Study program.

4.2 Procedures

This research aims to draw conclusions from a purely qualitative research approach. Yin (2014) states that a case study is useful for answering the questions of how and why for a social problem, such as what encourages students to pursue research activities at the undergraduate level of education. Moreover, Stake's (1995) exploratory single case study approach was selected because it utilizes a constructivist foundation that complements the educational context of this study. The literature supports a gap in research regarding extended research experiences commencing prior to a student entering a higher education institution (Amaya et al., 2018; Claessens et al., 2016; Lile, 2017). Data

Table 1: Participants (pseudonyms)

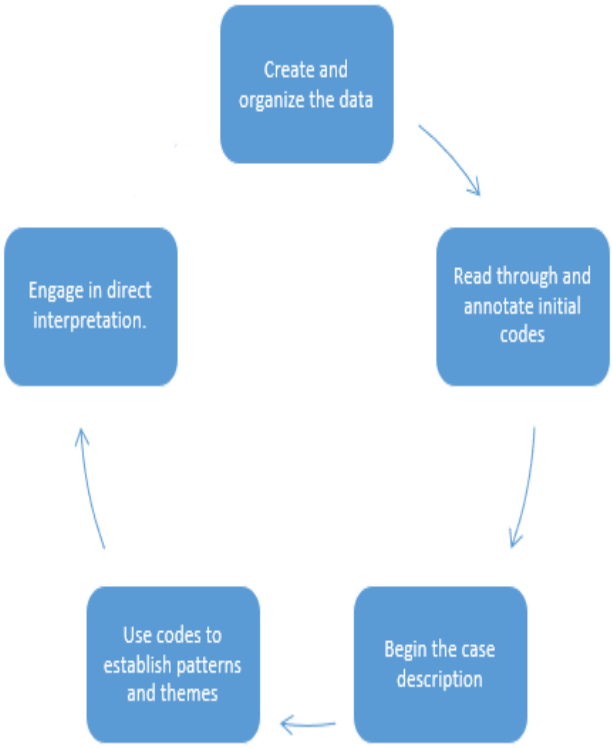
PSEUDONYM	Major(s)	Minor(s)	Post-Graduate Plans
CARSON	BS. in Engineering Physics	Applied Mathematics, Computer & Electrical Engineering, Computer Science	Pursuing a M.S. in Engineering Physics, then plans on pursuing a Ph.D. in Cosmology
ELIJAH	BS. in Engineering Physics	Applied Mathematics	Industry
JACKSON	BS. in Engineering Physics	Applied Mathematics & Aviation Law	Pursuing a M.S. in Optical Physics, then plans on pursuing Law School
LIAM	BS. in Engineering Physics	Applied Mathematics, Computer & Electrical Engineering, Computer Science	Civilian physicist for the U.S. Military and pursuing his M.S. in Applied Physics
OLIVER	BS. in Meteorology & Computational Mathematics	None	Industry, turned down full ride for M.S. Plans to return for a Master's degree after two years industry experience

was collected from interviews and three short individual narratives. The narratives probed the experiences that the students had while undertaking research as concurrently enrolled students. Each narrative was between 200-300 words in length. The five participants satisfy both Yin (2014) and Creswell and Poth's (2018) suggestion for employing at least five participants for purposeful sampling. It is important to note that this study was not designed to yield generalizable results but to generate an understanding of the phenomenon and lay a foundation for future inquiries.

4.3 Data analysis & theoretical framework

The data analysis for the investigation was purposefully undertaken. First, all interviews were transcribed and sent back to the participants for review and approval. After receiving approval from the participants, the researchers read the transcriptions of the interviews individually and exercised memoing as they immersed themselves in the data. While reading through the transcripts, the researchers created notes in the margins of the data, beginning with the development of the codes and then the formation of themes from the codes. This coding strategy for these major categories of information is referred to as open coding (Creswell & Poth, 2018). Merriam (2009) suggests that assessing the codes is the initial step in categorizing and gathering meaning from the data. Furthermore, reviewing open codes and grouping similar data together into axial codes created "coding that comes from interpretation and reflection of the meaning of the data" (Merriam, 2009, p.180). Figure 1 depicts a visual representation of the data analysis steps.

Figure 1: Case-study data analysis visualization



Note: This figure is an adaptation of Creswell & Poth (2018) data analysis and representation by research approaches table (p. 199).

Tinto's (1993) theory of student departure was the guiding theory chosen to frame the present study. There have been five areas that Tinto (1992; 1975; 2012) has identified, as his conceptual model has evolved, that deter persistence among students in higher education: expectations, advice, support, involvement, and learning. However, the theory of student departure makes a strong argument to validate that the interactions between perceptions and behaviors of students play a key role in the integration and persistence in academic environments. Given the unique circumstances of the present study, Tinto's (1993) theory of student departure enabled the researchers to remain focused on how a faculty member's expectations, advice, support, involvement, and facilitation of learning impact students' post-graduation decision-making.

4.4 Personal perspectives

The applicable faculty advisor that transitioned from the high school program to the University is one of the paper's authors. Consequently, this individual did not formulate

any of the student questions so as to not lead the students' answers toward any particular outcome. Further, this research team member was removed from the data collection portion of the project as to not influence the students' responses, perceptions, and descriptions of the questions during any of the interviews. Therefore, these measures taken by the authors can be considered a delimitation for the present study.

5.0 Findings

One of the questions that the research team sought to explore with this cadre of students, and the specific focus of this work, is the role that working with the same mentor and student cohort from concurrent enrollment through undergraduate graduation had on the students' subsequent academic and career decisions. To obtain this insight, students were both individually interviewed and asked to offer written responses to three prompts. To ensure the integrity of the students' answers, each student was informed that the confidentiality, anonymity, and privacy of their responses would be protected and that they could withdraw from the study at any point in time without consequence. Individual interviews lasted for an average of 15 minutes each and the researchers obtained 14 pages of transcribed text in total from the five participants, totaling approximately 7,000 words. Following the interviews, students were asked to provide 100-200 word responses to three narrative prompts inquiring about their rationale to pursue or not pursue graduate-level higher education. These responses resulted in nearly 2,100 words spanning approximately four pages. The interviews and the narratives were coded together and resulted in 233 coded frequencies (see Table 2) leading to a total of three central themes coded from preliminary data analysis. The most prevalent themes that emerged were: connection to industry, motivation through research, and relationship over time.

Table 2

Theme	Files	Coded References
Connection to Industry	6	80
Relationship over time	6	77
Motivation for Research Agenda	8	76
TOTAL		**233**

5.1 Connection to industry

Students, upfront, frequently expect an undergraduate research experience to reflect the college laboratory experiences that they have experienced to date, where procedural guidance is provided and the desired outcome is planned (Linn et al., 2015). However, there was a general sentiment across the cohort that participation in an unscripted intellectual endeavor, that is to say, the research that the students concurrently participated in, was one of the more enjoyable aspects of their concurrent enrollment and undergraduate experience. More to the point, the less scripted nature of the work in the mentor's lab was perceived to be more reflective of the daily tasking that each was working toward following graduation. This perception drove subsequent academic and career decisions and highly influenced the student's feeling of job and graduate school readiness.

Besides the stated reward brought about by the mentor, "treating us as engineers and expecting us to come up with a practical product," there was profound value perceived in the development of ancillary skills, not typically developed in the classroom, that the students felt better prepared them for industry or their other post-graduation plans. Elijah attributed the extended research experience to, "helping me develop things that cannot be seen on paper, like professionalism, writing an email or useful report, appropriately structuring a spreadsheet or commenting a code." Jackson believed that the ancillary skills that Elijah highlighted, "might take a few weeks or months to develop on the job" and that the opportunity that this experience offered, "to develop or improve these skills before getting a job provides an advantage." Liam singled out the mentor's, "advice on how to reach out to a vendor or supplier when a problem is encountered" as being invaluable when heading into industry. The consensus on the perceived value in developing these ancillary skills is a benefit not often touted in lieu of or complementing the more often promoted gains in intellectual, academic, and research maturity (Byars-Winston et al., 2016).

Each student also saw tremendous value in the opportunity that their extended undergraduate research experience provided to preliminarily 'test' their expressed industry interest before completing the entirety of their upper-level courses. This was specifically enabled by the opportunity to begin an undergraduate research experience during their concurrent enrollment, along with the opportunity to undertake relevant coursework early in their concurrent enrollment. Oliver noted that his work in the mentor's lab revealed an affinity for working with big data and subsequently led to undertaking a dual major in computational mathematics. Oliver shared that the experience allowed him to, "learn about myself and was helpful to find a career that I wanted to at least start off in." Carson pointed out that,

> I know people who have changed their major because of a project or internship. They realized that they didn't actually want to do something for the rest of their life. While this was not my experience, I was still thankful for the chance.

Liam stated that it was the research that he participated in that dictated the type of masters program that he wanted to undertake because it helped him, 'think through things that I do and don't like," and, similarly, Elijah broadly stated the "research exposure showed me the options that the world has to offer."

In conjunction with the general research experience, and how it informed future decisions, was the role of the mentor themself and the industry perspective and networking opportunity that the mentor provided. The close relationship

that each of the students developed with the mentor resulted in a multitude of varied outcomes that further informed their subsequent decisions and their perceived readiness for what came next. Outcomes spanned from several students feeling as if their contributions were more valued, assistance in building a code of professional ethics, direct guidance in applying concepts learned in the classroom, and just having someone you could attempt to emulate. In addition to the fondness for working with a mentor that exhibited passion, that multiple students pointed out, Jackson found it beneficial to, "have a former industry professional who has been through a lot of different situations in life as a sounding board" but also found additional value in the network that he was able to plug him into. Furthermore, Jackson shared,

> [My mentor] was able to refer me to a friend who received an undergraduate degree in engineering, went on to law school, and became a patent attorney. This conversation helped me find a career path that fit with my interdisciplinary interests.

Overall, the perception that the extended research experience more closely mirrored the nature of industry tasking, along with the personalized perspective that the mentor provided for industry, provided a feeling of being better prepared for post-graduation endeavors and increased confidence in the decisions that they have made to date.

5.2 Motivation through research

The second major common theme that emerged from the interviews and surveys was how the research, close-knit student cohort and mentor emboldened the individual cohort members to seek ambitious goals and persevere during the challenges that inevitably followed. For Oliver, "the research showed me what I was capable of" and, for Elijah, "it showed me that I could be successful even when my class grades did not necessarily reflect that. I would have had no hope in completing this degree if the only feedback I received was from the classroom." When Liam was offered the opportunity to enter into the research group via an early concurrent class capstone project, and after being captured by the material of his first concurrently enrolled class, he stated that he "made a complete 180 degree turn and fully dove into academics and studying." Later, when Liam had the opportunity to publish and present at professional conferences, "besides helping me grow, it totally changed the way I viewed myself in that I could not have previously seen myself doing things like this." For Carson,

> Participation in GAI and continued research during my time on campus prevented me from fading into the background, which I think can happen a lot. On a small team, I knew I would have more interactions with peers and the professor and that this would keep me engaged.

Jackson said that his participation in GAI assisted him in doing exactly what he set out to do, "I always wanted to push my academics as far as I could from an early age. The Gaetz program provided an avenue to do exactly this." Upon reflection and observation, Jackson was already able to identify how research motivated many of his peers external to the cohort, along with classmates at his University. Jackson, continued, "During my study away and internship, I've seen a lot of kids who have done research early on go on and pursue their Ph.D. or get a big time job at SpaceX or a company like that."

Carson stated, "The support system provided by the group during concurrent enrollment made the idea of doing this degree and doing something out of the ordinary seem possible." For all, the support system created through the close-knit cohort provided reassurance and reduced the intimidation factor. Jackson shared that he, "had plenty of passion but there was still intimidation. The group provided someone to reach out to when you were afraid." Liam put forth, "I think it worked out well because we all developed a good rapport back in high school and got to know one another because we knew that we were undertaking something challenging." Elijah gained confidence in simply "seeing that people with the same background as me were accomplishing similar coursework and research as an undergraduate." Overall, as the students accomplished more and more formidable challenges, it bred confidence.

While Oliver similarly found that "[the mentor] provided encouragement to pursue my goals and the confidence to face an intimidating task," discussion unveiled that the mentor had a far more nuanced role in how the mentees approached their future endeavors. Jackson specifically recalled leaving his high school campus and coming back for evening activities and still finding his professor there, "Seeing the accumulation of all of the hours that I saw him put into research and the tangible product, it motivated me to dedicate myself to something." Many years later, Elijah attributes this instilled work ethic to getting him his first internship and a future job offer,

> While I had worked on a small class project in the past in electro-optics, I had no real relevant experience. My boss was motivated to hire me despite not having any real experience because of the work ethic that I was able to demonstrate through my research products from the lab.

For Carson, "Professor taught me how to factor in a practical perspective but what [they] really instilled was a hard work ethic." While Liam previously attributed the cohort experience to him making a 180 degree turn in how he approached his studies, he went on to say that, "The program and instructor helped me realize that to do what I wanted to do that I was going to have to put in a lot of extra work and make some changes. His passion motivated [sic]."

5.3 Relationship over time

With the important role that comradery played within the cohort already being addressed, the extension of this feeling toward the mentor is also evident. However, student feedback spoke directly to the strong role that this relationship played in long-term decision-making. Liam acknowledged that,

> When I look back on my life I know that there will be a handful of people that really changed the direction of it. Sometimes good and sometimes bad. But, when I look back on my life I know [mentor] will be one of the people who is going to have the biggest positive influence on it and its direction.

Liam went on to further say,

> I truly struggled to decide what I wanted to do for college but thanks to [mentor] and the GAI program, I was able to choose a degree in Engineering Physics. I'm not sure that this would have been possible without the guidance of [mentor] and the program. [Mentor] is somebody I would like to continue to have in my life and have a continued relationship with.

However, the longevity of the mentoring period and how it consequently blended the nature of the mentoring to both personal and professional guidance, appears to be the most impactful aspect of the relationship. Jackson noted that, "We see [them] every week. So, it got more and more intimate. It was professional but a friendly environment." Oliver characterized this fluidity as "a very seamless transition between professional mentoring and mentoring on a more personal level." Ultimately, this dynamic led to a fundamental shift in how the students viewed a faculty member, an increase in research productivity, and a more mature evaluation of future options. Jackson said that the nature of the relationship "humanized professors." Many within the cohort felt that the close relationship increased research productivity, with Elijah sharing that, "we knew what to expect and what he would demand of us," and Carson indicating that, "Our relationship with [mentor] enabled a faster progression of results in the lab because we were not fearful of presenting our results." Jackson and Carson saw an analogy between life and the undergraduate research experience that they participated in. Jackson offered,

> There are a lot of life lessons that go along with undergraduate research. You try to tackle problems with the knowledge that you have but there is a lot that you don't know. Each have [sic] a lot of problems that you have never encountered before.

Carson found that, "both research and the real world don't have clearly defined problems or solution manuals." However, Liam jumped in and stated, "The way [mentor] structured [they] questions prompted us to think, self-interview, self-analyze and determine if this was the best way to solve a problem. This method has guided my overall decision-making process."

6.0 Limitations

Qualitative research aims not to make a generalization but to gain a deeper understanding of certain phenomena (Creswell & Poth, 2018). The researchers were particularly interested in the process, meaning, and understanding of the participants' lived experiences. The sample size was a limiting factor in this study, as the researchers focused on the richness of the data collected rather than its generalizability. Also, the research site was another limiting factor as the findings cannot be extended to broader populations with the same degree of certainty that quantitative analyses can. However, a pure qualitative case study methodology was needed to understand how a faculty mentor can encourage students to pursue research activities at the undergraduate level of post-secondary education.

7.0 Conclusion & future research

7.1 Conclusion

In keeping with the case study purpose, this research further significantly contributes to the body of literature on students' perceptions of research. Using the framework outlined by Tinto (1993), the investigation was able to support his concepts that faculty advisors play a critical role in student success when they embark on future endeavors. Ultimately, three major themes emerged from this case study: relationship over time, connection to industry and motivation through research. Each of these themes align with Tinto's (1993) theory of student departure and the resultant persistence that occurs within a student. While persistence was not a common theme that explicitly emerged, it can be indirectly connected to all of the major themes observed.

In this case study, the participants all expressed that the faculty advisor was a key aspect of their success during their undergraduate experience as well as a support structure when it came to making decisions about their future. Establishing this relationship early in the student's higher education experience, and allowing this relationship to evolve over numerous years, afforded the students a unique and more personalized relationship with the mentor and, consequently, more personalized mentoring with the faculty advisor compared to what they experienced with other professors that they worked with over a shorter time frame. While not all students chose to pursue graduate education as their next step, none of them felt that it was outside of their capabilities. This result lead this team to conclude that RQ 1 can be answered by stating that students' confidence in their career field as an entry level professional is positively impacted by early exposure to research. The students who chose to go directly to industry, rather than graduate school, also expressed the importance of their undergraduate research experience in their ability to obtain employment following degree completion. Further, it emboldened their confidence in their ability to contribute within their desired industry. Finally, the connection they perceived between the research and their future careers provided continued motivation while progressing through their coursework. These results indicate that higher education institutions should make significant efforts to not only create opportunities for student research but also incentivize peer recruitment into these projects.

The participant size was too small to conclusively answer RQ 2. Additionally, more time would need to pass to answer this question in totality. Two of the participants are pursuing graduate research and both of them plan to continue through a terminal degree. Another participant plans to return to graduate school and pursue research efforts after

their initial year of contract work while another plans on a similar path of returning after some time in industry. While 80% of the participants are pursing graduate level research or plan to return in the near future, further research to determine if this actually happened is required.

7.2 Future research

Future research efforts should be undertaken to expand analysis of this entry level data to larger scale evaluation of the impact of students' early engagement in research with a long-term mentor and how this impacts post-graduate performance. Implementing the aforementioned strategies into groups of different degree programs will give a more objective indication that our found themes have on students' post-graduate paths. Additionally, incorporating a gender mixture could provide further insight as, traditionally, science and engineering have been male-dominated professions. Finally, following up with this set of students after a number of years may prove beneficial in adding to the understanding of how this research experience truly connected to their career applications; contrasting their perceptions against that of colleagues who did not have an analogous undergraduate research experience.

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