# Pilot Study of Student Success Strategies for Engineering Technology Students at Three Ontario Colleges

EDU 776 Capstone Project

Submitted in Partial Fulfillment of Requirements for the Degree of Master of Arts in Education

(Community College)

Central Michigan University

Submitted by:

Denise Devlin-Li

Submitted to:

Dr. Michael Stacey

Capstone Advisor

March 2016

**Abstract**

Every year thousands of students enter post-secondary institutions with the intention of successfully completing their programs, graduating and getting a job. Far too often this is not the case, and in the Ontario college system the graduation rate is currently about 66% (Colleges Ontario, 2015). But the provincial economy depends on these graduates for meeting the labour market skills shortages now and in the future (Miner, 2010). Of particular interest for the economic and skills needs of the future are the engineering technology graduates.

The colleges have been focused on increasing the number of students who graduate and increasing graduation rates. They have implemented many strategies for student success. But how do college administrators, especially college deans, know which strategies are working for their groups of students? The purpose of this pilot study was to begin to determine which student success strategies may be working for one group of students in particular, the engineering technology students.

There were three deans of engineering technology programs at Ontario colleges interviewed. The deans identified many strategies that seemed to be effective at retaining students in their programs. These strategies ranged from those implemented by their colleges for all students to those unique strategies implemented by one or two of the deans themselves.

The deans and the findings of the literature review agreed on the value of student success strategies in the following categories: Classroom Experience (Tinto, 2012; Pascarella & Terenzini, 2005), Active Learning (Christie, 2013), Mentoring (Christie, 2013), Academic Advising and Freshman Seminar/orientation (Braxton, 2014; Lim, Tolley, Warren & Tkacik, 2011). However two or three of the deans identified strategies that were school specific and not

found in the literature review. These strategies were: Faculty Professional Development, Early Intervention, Industry Connections/mentoring, Pre-enrolment Activities and Course Recovery. The third and final categories were those unique strategies that were identified by only one of the deans for their students. These initiatives were: e-textbooks, Academic Plan and a Your Story Marketing campaign. There were no equivalent strategies identified in the literature for these strategies.

Overall there is no shortage of activity around success strategies for engineering technology students in the three colleges. There seems to be success in many of the strategies. The next step is to expand the study to all of the 24 Ontario colleges. This may further validate the success themes identified in this study and may identify many more strategies that are working to increase student retention and therefore graduation rates. Sharing these strategies amongst all of the deans could enable them to make informed decisions around which strategies might be best for their engineering technology students.

**Acknowledgements**

My sincere thanks to everyone who has supported me in this journey toward the MA-Education. I am especially grateful for all of the resources made available to students by the CMU Global Campus group. The writing center provided very helpful feedback on my work from the very first course to my literature review for the capstone project. They were available all year round. The library was a source of information and guidance for finding all types of literature. I don't think there was any document they could not find for me.

The GBC cohort was an inspiration themselves. There were so many informative group discussions and presentations. They provided me with the empathy and support that I needed at times to persist in the capstone project.

Dr. Stacey, our capstone advisor, provided high standards for the final report. He always provided very timely feedback on my drafts.

Finally I would like to thank my husband for his patience and understanding while I persisted in obtaining the Master's degree.

**Table of Contents**

## List of Tables

# Chapter 1: The Problem Defined

## Introduction

Every year thousands of students enter Ontario college programs with the intention (and hope) of finishing their programs and starting a career related to their studies. Indeed enrollment at Ontario colleges has been increasing from 168,000 full-time equivalent students in 2003-2004 to over 220,000 in 2015 (Colleges Ontario, 2015). This marks the highest enrollment in the history of the Ontario college system.

However, historical data shows that over 30% of these students will not complete their programs. Student graduation rates are a major concern in post-secondary education. In general the rate of attrition in post-secondary education in Canada is around 30% to 50% (Dietsche, 1989, as reported by Dale & Sharpe, 2001).

But in recent years colleges have been focused on reducing student attrition and improving student retention and thus increasing the graduation rate. Colleges have implemented various strategies to improve student retention. Their efforts have shown results. The graduation rate has been increasing from 60.1% in 2007 to 65.8% in 2014 (Colleges Ontario, 2015). However there is still more opportunity for improvement and more that can be done to increase student retention and therefore improve graduation rates across college programs.

## Statement of the Problem

Students enroll in many programs and the retention of college students in all programs is an important issue. The retention of engineering technology students in particular is important for Ontario colleges and the economy of the province. Engineering Technology students comprise 8% of total college enrolment (Colleges Ontario, 2015) and these graduates will be needed in the future as the skills demanded by the workforce increase.

The graduation rates of Ontario college engineering technology programs hover at or below the college provincial average of 65.8%. For example the 2014 aggregate graduation rate for electronics engineering technology programs is 57.8%, and for mechanical engineering technology programs the rate is 61.8% (P. Van Horne, personal communication, January 11, 2016). However the need for graduates from technology programs is especially important for the economic prosperity of Ontario as the workforce will require progressively more skilled employees (Miner, 2010).

The requirements of the labor market are changing. Manufacturing and the knowledge economy jobs are increasingly requiring education or training beyond high school. In 2014, Linda Franklin, Colleges Ontario Chief Executive Officer and President stated that "people now see the purpose of post-secondary education as gaining workforce training and landing a good job, and that's the reason (colleges) were created" (Rushowy, 2014). Students come to college to prepare for a career, and there is a high demand for skilled graduates.

Career preparation is cited as the most important reason for applying to a college program by 78% of survey respondents (Colleges Ontario, 2015). Therefore the main goal for most students in choosing their program, regardless of college credential, is to prepare for employment (Colleges Ontario, 2015). It is expected that 77% of the Canadian workforce will need post-secondary credentials by 2013 (Miner, 2010). Currently Ontario has about 60% of the labor force with education beyond high school (Miner, 2010). This implies that a better educated workforce will be needed for the jobs of the future. Although students are entering the college system in record numbers, the graduates from these programs are not entering the workforce in sufficient numbers to meet the expected skills shortages. The Conference Board of Canada reported in

2013 that the skills mismatch costs the province as much as $24.3 billion a year in Gross Domestic Product (GDP) and $3.7 billion in provincial tax revenues (2013).

Colleges are especially important in solving the skills shortages of the future because they provide the education and skills to meet the needs of employers. Since many of these skills are technical, there will be an increasing demand for engineering technology graduates. In addition to addressing skills shortages, college graduates are needed to drive innovation, which in turn stimulates the economy. The Conference Board of Canada has argued that there is a relationship between the number of science, mathematics, computer science, and engineering graduates and future prosperity and that Canada is not producing enough graduates in these fields to stimulate innovation and develop new products (Munro & Haimowitz, 2010).

Colleges have an important role to play in supporting innovation because they graduate students in technical areas including computer and engineering technology. Many colleges are now partnering with industry on applied research, and research is a pillar of innovation. Every graduate from the college system in engineering technology and related fields is needed to support innovation and build the economy.

However, addressing skills shortages and increasing innovation are not the only reason to ensure as many engineering technology students as possible graduate. There are financial implications to both the student and the college if the student does not graduate.

A college graduate will earn more over their lifetime than non-graduates. Recent estimates show the rate of return to a graduate upon obtaining their first postsecondary degree or diploma at between 11 and 17 percent per year (Higher Education Council Quality Assurance, 2013).

The cost to the institution of students who leave is substantial. It costs far less to retain students for the three years needed to complete their programs than to recruit new students. Noel-Levitz studies show that recruitment costs at two-year colleges have increased from $74 per student in 2005 to $263 per student in 2010 (2013). This is a substantial increase and costs are continuing to rise.

When a student leaves college in Ontario the institution loses both the tuition the student pays and the government grants that each student brings to the college. The total of tuition and grant is about $7000 per year per student (R. Helman, personal communication, March 10, 2014). Thus it is far better to retain a student through three years of college than only one year or less.

In addition to all of the financial and economic reasons to increase graduation rates, there is also a human factor that should be considered. Colleges are accessible to many people, and provide an education to a much wider group of the general population than universities. For many students who attend college the choice is not so much a choice of which college or university to go to, but a choice between a college and not going at all.

Ontario colleges pride themselves in being access institutions providing a post-secondary education to many students who would not usually pursue education due to real or perceived barriers (Deloitte, 2012). People with weak academic backgrounds, physical or emotional barriers or other challenges will be left behind in the new economy. Many students find the college programs challenging to successfully complete.

Engineering technology programs in particular can be challenging because of the mathematics and technical requirements of the program. But there are rewarding careers for graduates of these programs. There are many reasons to ensure as many engineering technology students graduate as possible–from the students own personal success in finishing a program

which leads to a career to meeting the needs for a skilled workforce and even to the financial wellbeing of the college itself.

**Purpose of the Study**

Although colleges are increasingly focused on student success and increasing graduation rates, there does not appear to be any universally proven and adapted retention strategies that work for all college students. It is even less clear if there are strategies which work for specific groups of students based on the programs in which they are enrolled. Engineering technology program students are one such group of students.

The purpose of this qualitative research was to begin to determine which retention strategies have shown that they might be successful in increasing student retention for engineering technology programs**.** The researcher gathered data from the deans of three colleges on the strategies that have been tried in their colleges to increase student retention.

From this data the researcher hopes to identify student success strategies that the deans, who have a good understanding of students and of student retention, have found to be successful for engineering technology students. The next section identifies the two research questions that are the basis of this study.

**Research Questions**

Qualitative data was gathered from interviews with the deans of engineering technology programs at three large colleges in Ontario. Participants were asked three open ended questions during a one hour interview. The interview questions addressed the following two research questions:

- What retention strategies have been implemented at your college?
- Which retention strategies are proving successful for engineering technology students?

The following section describes the study scope and assumptions.

## Scope and Assumptions

There are 24 public colleges in Ontario. This is a pilot study and the sample size was limited to three colleges. These colleges were chosen because of the large number of engineering technology programs and students enrolled, and because the colleges were within a two hour drive of Toronto. The dean of each engineering technology school was asked the same three questions during a one hour interview. There was no other means of data collection.

The researcher sought to determine what student retention strategies seemed to be effective at increasing student retention in the engineering technology programs and to determine if these strategies were consistent with those identified in the literature review. Finally it was assumed that the study's participants answered the research questions truthfully and candidly. However there are limitations to this study that are identified below.

## Limitations

Limitations of the validity of the study may result from the sample size. The research was limited to a small selection of participants from the entire Ontario college system. Three deans were interviewed and all were from large urban colleges located within a two-hour drive of the researcher's base. This is convenience sampling (Creswell, 2012) and may not be truly representative of the population as a whole.

While the deans were chosen because they are senior administrators at their colleges with good knowledge of both college and school level retention strategies, they may not be aware of all the student success strategies being delivered, and to identify them in a one hour interview. The term "pilot" in the title of the study acknowledges the small sample size and the exploratory nature of the research.

A pilot study by definition is a research study conducted before a similar large-scale study (Payne, 2015) to see if the methodology and research questions are feasible on a larger scale. The research for this project was on a small number of participants (three) but if the study seems to yield significant results it could be expanded to a similar study for all 24 colleges. Although sample size was a limitation, time was also a limitation.

It takes time it actually to gauge the success of the retention strategies. Many of the strategies were implemented within the last couple of years. Since technology programs are two and three years in length it will take two to three years to determine if students persist and remain enrolled in their programs and graduate**.** Some of the strategies may look promising, but longitudinal and quantitative data may not yet be available.

An additional limitation was researcher bias, as the researcher is a peer of the deans who were interviewed. There may also be bias from the participants as they are deans from colleges that could be perceived as competitive to the researcher's own college, and therefore less inclined to share all their strategies. The researcher endeavored to mitigate researcher bias by adhering strictly to the interview questions and a commitment to share the findings with the participants while retaining anonymity of the participants. The following section provides the definitions of terms used throughout this study.

**Definition of Terms**

**Engineering Technology Programs:** Two and three year college programs that meet the standards of technology programs as identified on the Ontario Ministry of Training Colleges and Universities Postsecondary Education Partners' Gateway.

**STEM Programs:** These are programs in the areas of science, technology, engineering and mathematics programs.

**Colleges:** In this paper the term "college" or "community college" refers to the Ontario publically funded post-secondary institutions granting certificate, diplomas, advanced diplomas and degrees with the focus on applied education. There are 24 colleges of applied arts and technology in Ontario.

**Student Retention**: Student retention is the college's ability to retain a student from admission until graduation in their program. In the context of this study student retention refers to a student entering an engineering technology program and graduating from the same engineering technology program.

**Student Persistence:** The ability of a student to remain enrolled in the program from one semester to another.

**Graduation rate**: In this study the graduation rate is determined to be the percentage of the total number of students who graduate from a program compared to the total number of students who started the program. The time period for the calculation is twice the length of the program. This is consistent with the Colleges Ontario calculation for KPI graduation rates. (Colleges Ontario, 2015).

**Key Performance Indicators**: Since 1998 the Ontario colleges have been mandated by the Ontario government to collect and record data in five key areas: graduate satisfaction, student satisfaction, employer satisfaction, employment rate, and graduation rate.

# Chapter 2: Literature Review

Student retention, and improving graduation rates, have been an increasingly important issue for colleges. Chapter One provided evidence to indicate that Ontario colleges were focusing on the issue of student retention but also provided reasons why it is so important that students are successful in their programs. The efforts of the colleges seem to be working and over the last seven years the student graduation rate has improved from 60.1% to 65.8% (Colleges Ontario, 2014) in the Ontario college system.

But the colleges have been trying many different strategies and some may have worked better than others. Decades of research have resulted in an expansive body of research on factors which affect student success and engagement and therefore graduation rates, so there are many strategies to choose from. But identifying and verifying the specific strategies that increase student retention for any given group of students has proven to be a difficult challenge.

The purpose of the literature review is to identify the student success strategies that many years of research have shown to be successful. These strategies are grouped into categories and these categories will be used to determine which strategies seem to be most effective at increasing student retention for engineering technology students at three colleges in Ontario. The literature review starts with a brief history of two of the most widely recognized and cited researchers in the field of student retention: Alexander Astin and Vincent Tinto.

## History of the Research

The fundamental research of Astin and Tinto is the foundation on which North American student success strategies have been developed for post-secondary students. A review of Astin's and Tinto's work and it's influences on determining student success strategies is followed by a

more detailed explanation of eight categories of current student success strategies with examples from engineering and areas related to the engineering technology programs in this study.

Astin (1984) identified that merely attending college is an experience that affects students in many ways, and whether a student persists in their program and goes on to graduate is influenced by several factors including their own personal attributes when they enter college.

Astin's "Input-Environment-Outcome model" was based on the concept that student success depended on who the student was before they entered college, and how the college experience affected, or changed them while at college (1984). Whether a student graduated or not was viewed as a function of three elements: inputs (the student themselves just as they enter college), environment (institutional and external influences while at college) and outcomes (skills and attributes of the graduate) (Pascarella & Terenzini, 2005). Astin (1984) theorized that the greater the student's involvement in college, the greater will be the amount of student learning and personal development. This concept of involvement, and Astin's I-E-O model provided the basis from an extraordinary amount of research over the years (Pascarella & Terenzini, 2005).

Astin's model was helpful to identify the variables that influence student persistence but did not go on develop the interactions between the factors. Tinto published a student integration model in 1975 that became the seminal example of an "interactive model of student departure" (Tinto, 1975, 1998). Under Tinto's model a student's family background, skills and abilities and prior schooling interacted with one another to effect a student's commitment to obtain a degree and to remain at one institution. The commitment to both goals depends on the academic and social experiences of the student inside and outside of the college. If the experiences are positive the student will become more integrated into the institution and persist in their studies and graduate.

Tinto (1997) went on to refine this theory and noted that "academic and social involvement, it seems, matter somewhat differently in different educational settings. The clearest differences seem to arise between two and four-year institutions" (p. 167). He proposed that student social and academic integration is more important at four-year institutions than two-year institutions. In the American system most community colleges are commuter, rather than residential institutions. The majority of a student's community college experience is in the classroom, since most students are on campus specifically to attend classes and come shortly before and leave soon after the class (Seidman, 2012). This is similar to the environment at Ontario community colleges where the programs are two to three-years in length. There tends to be less social integration into the campus activities for college students in general. Therefor a student's academic involvement is more important than their social involvement.

This relationship between social and academic integration is an important differential for community colleges which generally offer two and three-year programs. Although a lot of attention has been given to improving retention at all post-secondary institutions, there has been relatively little research on retaining students at community colleges (Seidman, 2012).

Community college students are a different group of students than baccalaureate degree students. Tinto identified different student groups as needing different interventions and policies (Tinto, 1997). Thus engineering technology students, if identified as a particular group of students, might need many of the supports that all students require, but also specific supports that meet their unique program needs.

Post-secondary institutions realized, as Tinto identified in 1999, that they must offer a broad array of supports that are easily accessible to students. The recommended supports can range from those in the academic area, to personal supports and social services. But over the

years it has become apparent that student success is a complicated goal. The "vast array of recommendations to improve persistence rates can be overwhelming and confusing for educational leaders" (Braxton, Doyle, Hartley, Hirschy, Jones, & McLendon, p. 35). This vast array of strategies can be grouped into a few categories. The following sections will identify the categories of strategies which have been shown in the literature to positively influence student success. Each strategy has been linked to practices in research in the Science, Technology, Engineering and Mathematics (STEM) areas and where possible linked to practices in two year community colleges and Canadian community colleges. These areas most closely align with engineering technology programs which are the focus of this study.

## Categories of Student Retention Strategies

The strategies fall within eight categories: The Classroom Experience, Active Learning, Mentoring, Advising, Research, Freshman Seminar and Orientation, Learning Communities and Supplemental Instruction. The following sections highlight the research in each category, and why strategies in this category are important for student success.

### The Classroom Experience

Tinto described the classroom as "the building block upon which student retention is built" (Tinto, 2012, from Seidman p. 124). He believed that the classroom and the student's experience in the classroom were the focus of student retention. This is especially true for institutions such as Ontario community colleges, where most students are commuters. For these students the classroom may be the only place where students engage with faculty and with each other in the learning process (Tinto, in Seidman, 2012). Commuter students spend very little time on campus, and the time they do spend is in the classroom attending classes (Braxton et al.

2014). Within the sciences, mathematics and engineering fields, the studies of persistence support the importance of the classroom environment (Pascarella & Terenzini, 2005).

Although the climate within the classroom is known to be very important for student success, it has not been acknowledged in practice as such. In general, the climate of STEM disciplines is noted for being chilly and unwelcoming (Christie, 2013; Arizona State University, 2007). There is an infamous speech delivered by many faculty to freshman students which asks them to look to their left, look to their right, and one of these students would not be returning next semester. Faculty have long been proud of their program's reputation to weed out students who they deemed not academically capable of completing the program.

Arizona State University found that many students who left their STEM major were more satisfied with the student and classroom cultures in their new majors (2007). But research has shown that the students who left, or switched out of Science, Mathematics and Engineering (SME) programs had many of the same characteristics of the non-switchers (Ohland, Sheppard, Lichtenstein, Eris, Chachra, & Layton, 2008; Seymour, 1992; Zhang, Anderson, Ohland & Thorndyke, 2004). Students who left engineering were academically similar to those who persisted.

Developing a good atmosphere in the classroom is often related to the skills faculty have as teachers. Several quantitative studies exist linking student performance and positive faculty connections (Pascarella & Terenzini, 2005). However, most college faculty do not have formal training as teachers. They are hired because of the combination of education and industry experience that they bring to the programs. These faculty must learn how to teach.

Since faculty provide the classroom experience, faculty development must be a key aspect of retention strategies (Tinto, 2012; Kuh, Kinzie, Schuh & Whitt, 2005). Most colleges

today have centers for teaching and learning to provide professional development resources and training for faculty to become better teachers (Tinto, 2012; Kuh et al., 2005). Since the first year of college sets the foundation for success, it is important that students have the best experience possible in their first year classes. The best experience for the student is generated by the best faculty.

The University of Maryland's School of Engineering encouraged their best faculty to teach the critical first and second years of engineering and observed the retention rate from first to second year increase by 10% (American Society of Engineering Educators, 2012). Engineering faculty attending the National Effective Teaching Institute (NETI) course and implementing some of their ideas experienced an increase in student satisfaction by 67% (Felder & Brent, 2005). The data suggests that student feedback on teacher performance and follow-up teacher training can improve students' perception of the effectiveness of their faculty (Pascarella & Terenzini, 2005). Enhancing the skills and knowledge of the faculty is paramount for student success. Faculty must learn new or different ways of delivering course material that increases student engagement.

Many of the new teaching strategies that faculty are learning involve increasing the participation of students in their own learning–active learning. Tinto encouraged educators to move away from passive lecture based class delivery to pedagogies of engagement where the students were actively engaged with each other in the classroom (2004).

**Active learning**

Collaborative and cooperative learning and project or problem based learning are all examples of active learning. Meaningful interactions between faculty and their students are essential for high-quality positive learning experiences (Christie, 2013: Kuh et al., 2005).

Students learn best when they are actively involved in the learning process. Active learning techniques have been positively correlated to persistence, retention and overall student satisfaction in engineering education (Arizona State University, 2007; Christie, 2013; Smith, Sheppard, Johnson & Johnson, 2005).

Students who participated in active learning self-report a positive influence in understanding science, technology, arts and humanities subjects (Pascarella & Terenzini, 2005). Engineering students who participated in a collaborative design course self-reported greater gains in the professional competencies of group, problem-solving and design skills than the control group (Cabrera, Colbeck & Terenzini, 1998). The benefits of active learning far outweigh the difficulties that may arise in implementing it for technical subjects involving quantitative problem solving such as mechanical engineering (Felder & Brent, 2005). In addition to providing an engaging classroom where students are actively involved with their own learning, faculty's influence can extend beyond the classroom. They can be mentors to their students too (Terenzini & Pascarella, 2005).

**Mentoring**

Faculty mentoring of individual students is an example of a personal and professional relationship between a student and a faculty that encourages the student to persist. A mentor, whether a faculty or staff member, can be particularly effective for minority students (Upcraft, Gardner, & Barefoot, 2005). There are many examples in engineering of this relationship which is similar to that of a trusted coach and their athlete (Christie, 2013; Kuh et al., 2005). The Arizona State University Report (2007) on STEM persistence recommended each freshman be assigned a faculty mentor to help them feel connected to their program.

Students can also act as mentors to their fellow students. Incoming students may feel more welcomed and supported if they are mentored by a senior student (Kuh et al., 2005). Researchers in Quebec determined that a mentoring program between university and college students helped the college students persevere in their Mathematics, Science and Technology (MST) programs (Larose, Cyrenne, Garceau, Harvey, Guay, Godin, Tarabulsy & Dechenes, 2011). While mentoring is good for students during their program, students should be able to receive good advice on what program is best suited to them before they start the program.

**Advising**

Advising is important to the success of students especially if they are not sure they have chosen the right program (Tinto, 2012). Choosing the wrong program can decrease motivation, increase the likelihood of leaving the program, and dragging out the time it takes to complete a program (Tinto, 2012). Once the students have chosen a program and no longer need career advising, they need to know about course requirements, scheduling and other matters related to academics. Academic advising during the first year of college in particular is an important aspect of a students' first year experience and a strong influence on students' decision to persist (Kuh et al., 2005; Pascarella & Terenzini, 2005; Sutton & Sankar, 2011).

Several engineering schools have implemented academic advising initiatives. Washington University's engineering school assigns each freshman a first-year adviser and a four-year advisor for the duration of their program. The four-year advisor knows more about the services available college wide and builds a long term connection between the engineering department and the student while the first-year advisor understand the issues of transitioning to a first-year program (American Society of Engineering Educators, 2012). Non-traditional students particularly benefit from advising.

A mandatory academic advising process in a mechanical engineering program positively impacted student retention and graduation rates in first-generation and minority students. Technology is also making it easier for students to access advisors. Along with regularly scheduled sessions with their faculty, the students used an on-line advising tool which enabled them to book mandatory face to face meetings with their assigned faculty advisor (Crown, Fuentes, Tarawneh, Freeman & Mahdi, 2009).

Some institutions, recognizing the close relationship between academic advising and career advising/counseling have combined both services in a single area (Tinto, 2012). The effect of poor advising or a mis-understanding of the purpose of the advising can have detrimental effects on the students (Sutton & Sankar, 2011). There needs to be a close alliance of the work placement or CO-OP counsellors and the academic advisors where the information is exchanged about job opportunities in engineering or engineering technology (Sutton & Sankar, 2011). A study conducted in Newfoundland found that engineering technology students who were uncertain about their employment possibilities withdrew more than those who were certain. This student group did not have faculty advisors (Kirby & Sharpe, 2001). Applied research projects connected to industry are another means of introducing students to careers in their fields.

**Research**

In addition to student advising, engagement of students in research projects can be beneficial for student success. Recently Canada's community colleges and polytechnics have engaged in Applied Research. Applied Research (AR) is different than academic research because it is directly related to practical projects with industry, community, or government partners (Colleges and Institutes Canada, 2015). Studies have shown that students who engage in research during their first two years of college are more likely to persist in STEM majors

(Christie, 2013; Pascarella & Terenzini, 2005; Graham, Frederick, Byars-Winston, Hunter & Handelsman, 2013). But the first year of a student's experience at college or university is the starting point for the rest of the journey and is extremely important for their success.

**Freshman seminar and Orientation**

Institutions that implement initiatives such as the freshman seminar that are complementary to academic programs find that students do better academically (Kuh, Cruce, Shoup, Kinzie & Gonyea, 2007; Bailey & Alfonso, 2005; Pascarella & Terenzini, 2005). The first semester freshman seminar is commonly known in university as Intro to College 101. In college curriculums the outcomes of this type of course are linked to an understanding of careers in the field, ethics and student success. Pascarella and Terenzini (2005) identified the freshman seminar as benefiting all types of students.

While the freshman seminar provides information and supports students throughout the entire first semester, the student orientation is important when the students first arrive on campus. Braxton stated "Provide an orientation program for first-year students at the start of each academic term" (2014, p. 67). A study on the freshman experience for engineering students found that the students had a better understanding of the rigour of the program, and the engineering profession (Lim, Tolley, Warren & Tkacik, 2011) after they had a good orientation experience. But once the students have started their program it is important that they have the academic and social supports provided by a community. Programs delivered in a cohort model provide this community support, and students learn together.

**Learning Communities**

Learning communities are designed to provide students with the opportunity to engage with each other and with the institution, and ultimately to persist and succeed in their programs.

The research on the value of a learning community on student persistence is mixed with more research on four-year universities than two-year colleges (Pascarella & Terenzini, 2005). It is difficult to implement residential learning communities at colleges, since a high proportion of students are commuters.

The classroom is the only regular venue that most commuting and part-time students have for interacting with other students and with faculty. Therefore, the classroom must serve as a learning community for these students (Kuh et al., 2005; Bailey & Alfonso, 2005). Faculty are pivotal to ensuring students know what is going on in the institution and feel part of it and this information is conveyed during classroom time. But if a student is struggling to understand the content of a course, a learning community in the form of a study group, or supplemental instruction group, may provide what they need for success in the course.

**Supplemental Instruction**

Supplemental instruction (SI) has been implemented in traditionally difficult courses to improve student retention. SI is not designed to be remedial since it targets high risk courses rather than high risk students. SI is offered out of class and facilitated by students' peers. The leaders of the peer-facilitated session are students who have successfully completed the course and who are trained to provide instruction and support to the students attending the sessions.

A large study in the US on courses including physics which implemented SI found fewer low grades and withdrawal than on courses in the non—SI group (Pascarella & Terenzini, 2005). The study was done on traditional four-year university programs where one can find student facilitators. However SI has been successfully implemented in a two-year college for physics courses with a slight modification. Instead of fellow students teaching their peers, faculty were recruited based on student recommendations. Faculty actively promoted the sessions to students

in their classes (Hadsell, Burell-Woo & Enriquez, 2014). El Camino College, California, implemented SI for a Pre-Algebra course and saw 77.4% of the students who attended the class succeed, while only 59.5% of those who did not attend succeeded in the course over the same period (2002-2009) (American Society of Engineering Educators, 2012).

The University of Southern California also implemented SI with senior students sitting in on math course lectures and then offering weekly discussion sessions (American Society of Engineering Educators, 2012). Thus SI is one of many student success strategies. The following paragraphs summarize the key elements of these strategies from the literature review.

**Summary**

Decades of research has resulted in an expansive body of research on factors which affect student success and engagement. It is widely accepted that learning takes place in the classroom and beyond. However, what happens in the classroom, and the relationship between faculty and student, are still the most important aspects to student success (Tinto, 2012). Faculty have the opportunity to engage with students in so many ways, including research, advising and mentoring. Beyond the classroom the entire freshman year experience, including student orientation when they arrive, may have a positive effect on student retention (Upcraft, Gardner & Barefoot, 2005). Peer mentoring, supplemental instruction, and career advising are strategies which some institutions have found increase student retention (Tinto, 2012; Upcraft et al., 2005).

Most of the research has been carried out at four-year universities, primarily in the United States (Bailey & Alfonso, 2005). Community colleges are underrepresented in the literature; there was no research found specific to student success strategies for engineering technology students in Ontario community colleges. Although research on engineering degree students and STEM students may apply to two-year or three-year engineering technology students, there might

be enough differences in the students and the programs to warrant specific research. This pilot research may be able to identify if there are differences in success strategies used by the colleges and identified in the literature. But at the present time there are many strategies that have been identified and implemented for the general population of post-secondary students.

**Conclusion**

There does not seem to be any magic formula or single strategy that when implemented at an institution will guarantee to improve student retention. Braxton, Doyle, Hartley, Hirschy, Jones and McLendon stated that "Although there is wide agreement on the consequences of attrition for students and institutions, the vast array of recommendations to improve persistence rates can be overwhelming and confusing for educational leaders" (2013, p. 35).

The Engineering and Mathematics, Science and Technology programs have often adapted promising strategies from general programs to work with their unique group of students. In general, engineering students are similar to other students in terms of engagement including student-faculty interaction, institutional engagement and classroom engagement (Ohland et al., 2008). It could be assumed that some of the general student success categories identified in the literature review should work for engineering technology students enrolled in community colleges in Ontario. But because there is very little literature on community college students (Bailey & Alfonso, 2005) more research is needed to determine if the connection is valid. The purpose of research is to add to the existing body of knowledge on a topic (Creswell, 2012) and reduce the gaps.

There are gaps in the research on student success and retention strategies for students at Canadian colleges, and no research was found for engineering technology students in particular. As the enrollment in colleges continues to increase there is the need and opportunity for research

in this field. Evidence based research may benefit future engineering technology students and save colleges time and money from trying strategies that may not work.

# Chapter 3: Methodology

## Research Problem Restated

Students on college campuses today are enrolled in many programs in different fields of study. Student retention, which is connected to graduation rates for the program, is an issue across the institution. There are many strategies implemented by both the academic schools and other departments in the college that may increase student retention, but there is no consensus in the literature on any strategy which has proven to be universally effective. Student success strategies were identified in the literature review and fall into eight broad categories: the Classroom Experience, Active Learning, Mentoring, Advising, Research, Freshman Seminar and Orientation, Learning Communities and Supplemental Instruction.

The strategies that work for some groups of students, such as design or business students, may not work for engineering technology students. As identified in the literature review, different student groups need different interventions (Tinto, 2012). In the current climate of fiscal restraint it is not possible to investigate all of the strategies and determine which ones work best for any particular group of students. The purpose of this research was to begin to identify student retention strategies which seem to be successful for students enrolled in engineering technology programs at Ontario colleges.

## Research Methodology

The literature review in Chapter 2 showed limited research on retention strategies in Canadian community colleges, and no research was found on retention strategies for engineering technology students in Ontario. Educational research is undertaken to contribute to existing information on a subject and to improve institutional practices (Creswell, 2012). This research will contribute to the body of knowledge on successful retention strategies for all students, but in

particular the engineering technology students enrolled in Ontario colleges. Creswell stated "educators can learn about new practices that have been tried in other settings or situations" (2012, p. 4). Successful strategies identified in this research could be implemented in engineering technology programs across the Ontario college system. The research in this qualitative study is exploratory in nature and designed to broadly determine the strategies that are showing promise as effective in increasing student retention for engineering technology students.

**Research Design**

Qualitative research explores a problem in general terms so that the participants' views and experiences are gathered (Creswell, 2012). The research questions were general in nature to enable the deans to identify as many retention strategies as possible implemented by their college or by their own academic school, and to identify which ones seem to be effective for their students.

The participants were deans from three Ontario colleges who manage engineering technology programs. Participants were asked three open-ended questions during a one-hour interview (Appendix A – Survey Instrument). The interview questions addressed two research questions:

1. What retention strategies have been implemented at your college?
2. Which retention strategies are proving successful for engineering technology students?

The following three interview questions were asked, with a brief explanation for each one and the related research question:

**Interview Question 1**: What retention strategies have been tried in the academic school for students in engineering technology programs?

This question gave the dean the opportunity to identify any retention strategy he or she has tried for students in their school. These could be strategies that were either successful or not. It is helpful to identify strategies that were not successful as well as those that are so that future administrators can focus their efforts on the best strategies, rather than repeating activities that did not work. This question links to Research Question 2 above.

**Interview Question 2**: Which strategies have shown potential, or have proven effective, in increasing student persistence?

The first interview question focused on determining any strategies tried by the dean in the academic school. This follow-up question was focused more on the successful strategies and the reasons that they may be effective. This information answered Research Question 2.

**Interview Question 3**: Which strategies at the College level seem to be effective in increasing student persistence?

Every college implements student success strategies that affect all students from every program in the college. These strategies are offered by various non-academic departments including Student Services, Admissions, Career Placement, International Office and others. The purpose of this question is for the dean to identify any College strategies that may be helpful for engineering technology students. This question answers Research Question 1.

The interview questions are meant to encourage an open conversation about student success strategies in general, and student success strategies for engineering technology students in particular. The open ended nature of the questions eliminated the need to ask any probing questions to gather additional information or to clarify answers. The responses to the questions will be examined in Chapter 4: Data Analysis. The data collection process is described in more detail in the following section.

**Data Collection**

Engineering technology programs at large Ontario colleges are grouped together in an academic school within the college. An academic dean oversees the administration of each school. The researcher identified and contacted the deans of engineering technology schools at colleges in southwestern Ontario with the goal to have three participants. The researcher knows the deans from attendance at the Heads of Technology (HOT) meetings organized by Colleges Ontario. These meetings are held three times a year and have representatives from all colleges with technology and engineering technology programs.

The three deans are a sample of the overall population of Ontario college deans. These particular deans were chosen because their colleges were close to the researcher's base, they manage large academic schools with many engineering technology programs, and they were willing to be participants. Because of these attributes the sampling method falls under the convenience category of sampling techniques (Creswell, 2012). Three deans interviewed from a total number of 24 colleges cannot be a truly representative sample of the total college system.

However, their answers to the research study form a good basis for this pilot study. The pilot study could be expanded to include deans from all 24 Ontario colleges should the findings from this study warrant further research.

Once the deans have confirmed their interest in participating all of the appropriate ethics review approvals were followed as identified in the Ethics Review section below. Upon completion of the approval processes an interview time of approximately one hour was scheduled with each dean. The interview was conducted in person at each of the dean's colleges. The three colleges were within a 150 km radius of the city of Toronto. Each dean was asked three open-ended questions listed in Appendix A.

Interviews were recorded on a Sony digital recorder. The data was transcribed by the researcher within 10 working days of the interview. The digital recordings were deleted after transcription. The interview data was stored on a password protected computer in the researcher's home. The data will be kept until the final capstone project has been graded and the degree obtained ( MA – Education). Following this all electronic and hard copy files will be deleted.

**Data analysis**

The process identified by Cresswell (2012) was used to analyze and interpret qualitative data. There were three participants interviewed and the data was analyzed and coded manually. Coding is the process of identifying key words or short phrases in the text that capture or summarize the essence of what the participant is saying. The researcher first read through the interview transcripts to obtain a general feel for the ideas expressed by the participant. This exploratory reading is the first step in data analysis (Creswell, 2012). During following readings key phrases and words, or codes, were identified in each transcript. These codes were grouped together to form themes related to the two research questions.

Because the deans are knowledgeable about student success and retention strategies, the themes which emerged were consistent with terminology widely used in the college system and in the field of student retention. For example, the following phrases were identified in the transcripts: "student success advising", "academic advisement", "personal plans" and "student advising system". These phrases, or codes, were developed into a theme on academic advising. This theme identified one type of retention strategy which was proving successful for engineering technology students and answered both of the research questions. This process was repeated to identify all retention strategies in the transcripts.

The strategies were then analyzed to determine which one of the eight student success categories identified in the literature that they fell under, or if they were unique and outside of these categories. The categories are listed in the literature review: Classroom Experience, Active Learning, Mentoring, Advising, Research, Freshman Seminar and Orientation, Learning Communities, and Supplemental Instruction. Because this research involved human participants the ethics review process of Central Michigan University was followed and the participants were given the option to consent or withdraw at any time.

The study protected the anonymity of the participants and their colleges. The colleges were identified as College C, College F and College M. The data will be stored in a secure location in the researcher's college. A hard copy of the findings will be shared with the participating deans but the study findings will not be widely disseminated as per the CMU protocol for the Research Review Application (RRA) process.

**Ethics Review Process – RRA and REB**

Before any data was collected the researcher followed the Central Michigan University ethics policy and received written approval to do so from Central Michigan University (CMU). The Research Review Application (RRA) was submitted to CMU and approved (Appendix B – CMU RRA) before any other research approvals were obtained, in accordance with CMU policy and after discussion with the capstone advisor. Because this research was carried out at three separate independent colleges the researcher obtained approval from each college's Research Ethics Board (REB) to conduct the research. The approval letters were submitted to CMU and copies are attached in Appendix C – College C, F, and M REB.

Written permission was obtained from the Vice President Academic of each institution to access and interview each participant before the interview was conducted and before data was

collected (Appendix D – College C, F, and M VPA Approval). At the beginning of the interview each dean was given a consent form based on the CMU template (CMU, 2015) attached in Appendix E- Letter of Informed Consent and the interview protocol was reviewed. The participants were informed that their participation was voluntary, data would be anonymous, there was no compensation and they had the right to withdraw at any time, including after the data collection. The deans were not identified in the study, and the colleges also remained anonymous. Their signature was obtained on the consent form before the interview started. All appropriate documentation was completed and submitted to CMU.

## Chapter 4: Data Analysis & Results

Student graduation rates are a concern in post-secondary education and in recent years Ontario community colleges have focused on increasing their institutional graduation rates to address this concern. This institutional focus on graduation rates has resulted in an increasing emphasis on student retention and success at the program level in each of the academic schools within the college. However, student success is a complicated goal and there is no shortage of strategies which could be implemented to increase student retention. In fact, there has been an overwhelming amount of research in the area of student retention and it is very difficult to identify specific strategies that will increase retention (Braxton, Doyle et al., 2014). Added to the plethora of strategies is the fact that most of the research has focused on the success of baccalaureate degree students (Bailey & Alfonso, 2005; Ohland et al., 2008; Seidman, 2012). Very little research could be found on retention strategies in Ontario, or even Canadian, community colleges.

This lack of research makes is difficult to know which strategies have the most chance of success before implementing them in an Ontario college. While some strategies work for all students, there may be strategies that work better than others for specific groups of students – such as business students or arts students or engineering technology students.

The purpose of this qualitative study was to research student retention strategies which seem to be showing positive results for the retention of engineering technology students at Ontario colleges. The sample group for this pilot study was limited to three Ontario colleges within a two-hour drive of the Greater Toronto Area (GTA). Each of the colleges has several engineering technology programs that are clustered together and administered in an academic school. These schools are under the direction of a dean. The deans were chosen for the interview

because they have overall knowledge of the student retention strategies being implemented both within the school of engineering technology and by the entire college for all of the students.

The data was analyzed to determine repeating words or expressions of ideas. The repeated uses of key words or phrases lead to the development of themes. These themes or categories were used to identify the student retention strategies used by the colleges and are discussed in detail below.

**Results of the Study**

The following two sections summarize the student success themes that were identified from the data collected through the interview process with the three deans. Each section answers one research question and includes the interview questions pertaining to the research question**.** The themes, or categories, which identified the retention strategies related to the interview question are included in the analysis of each of the interview questions. The three colleges are identified as College F, College M and College C.

**Research Question #1** – Which retention strategies have been implemented at your college?

The goal of this question was to identify retention strategies that were implemented at the College level for all of the students. This research question was connected to one interview question: Interview Question 3: Which strategies at the College level seem to be effective in increasing student persistence?

The responses from the deans to this interview question identified several themes linking to college-wide retention strategies at each of their institutions. They responded from the perspective of identifying only the strategies that seemed to be working for their engineering technology students. The themes that were identified following an analysis of the data were:

New Student Orientation, Student Advisors, Fall Engagement Week, Math Support, and Curriculum Quality Assurance. Each of these themes is described in more detail below.

**New Student Orientation**

Two of the deans identified college orientation as being a student success strategy that worked for their students. The orientations varied in length from a week-long orientation at College F to a four-week "Program Launch" at College M.

The week-long FROSH type of orientation at College F offered many opportunities for the students from across the college to get together socially, and also provided information to the students on support services available to them. All program faculty are encouraged to release their students for various events during that week.

College M offered an extended program launch in concert with the College orientation that occurs over a four-week period while the students are attending classes. The dean at College M said "part of orientation theory is that a good orientation gives the students all the information on student services and where all the services are so they (students) know the services are there. There will be better student retention". The orientations are closely linked to the school programs and provide information on careers as well as program information and information on student services and College facilities.

College F also offered a day-long early orientation during the summer for all admitted students and their parents. The engineering technology programs participate and offer activities customized to their programs, including lab and facilities tours. In addition to the New Student Orientation activities the colleges provided support to the students during their program in the form of a student advisor.

### Student Advisors

All three colleges have implemented a model of the student success advisor. The advisors provide one on one support for students seeking advice or reach out to those who may be at risk of failing. The advisors work from offices near the faculty or school administration, providing front line support to the students. They work closely with the program coordinators, faculty and the Chair or Associate Dean.

In College F the student advisor reports to the Dean of the Engineering Technology Faculty, but attends monthly meetings where all advisors get together to share best practices and professional development. These meetings are organized by an academic dean outside the engineering faculty. It was a common practice amongst the colleges for the advisors from all the different schools in the college to meet regularly as a group to ensure they were providing consistent services to all students. Besides the student advisors there was also a change in the fall semester schedule to give students a one week break similar to the winter or spring break.

### Fall Engagement Week

Two of the three colleges have implemented a fall engagement or reading week. The program delivery at these colleges is divided into a 7-1-7 model. In this model the students have seven weeks of classes, take a one-week break, and return for another seven weeks before the Holiday season break between December 24 and January 1. This one-week fall break is relatively new, having been implemented at one college as recently as fall 2014.

The purpose of this week is to give those students who need it a mental health break and a chance to catch-up on courses. During the engagement week, the faculty provide make-up tests, labs or re-assessments for students who need them. There are also social events organized by the student services area and the student union to encourage students to de-stress and have fun.

When they are ready to work on the courses they may be struggling with, including math, the colleges have resources ready to help them.

**Math Support**

Math preparedness of students is concern at all three colleges. The dean of the engineering technology programs at College F said "We have a math committee in the college and they know, from having discussions with me, that math is a huge problem for us". This dean is an advisor to the College Math Committee, advising on tools which could encourage technology students to spend more time learning math skills, including gamification software.

Mathematics is the foundation course for the engineering technology programs and also for many programs in the college. Because so many students need math assistance each college has a central resource area for mathematics support. This resource is known by various terms including the Learning Centre or Math Learning Centre.

In addition to a central Math Learning Centre, two colleges also offer strategies to further assist their students with math. College M hires a senior, third year student who has done well in the program. This senior student joins a first year math class in the same program. The senior student then schedules a tutorial session and invites all of the students to attend. College F runs its own Math Drop-In Centre. The math and engineering technology faculty voluntarily staff the center and assist students with engineering related math questions. Mathematics is but one aspect of the entire program curriculum, albeit a critical one.

**Curriculum Quality Assurance**

Good curriculum was identified by all of the deans as being important for the success of the students. Program curriculum within the college system is governed by a Ministry mandated quality framework called the Ontario Qualifications Framework (OQF). The OQF assists

colleges in developing their quality assurance systems, which are required under the Ontario Colleges of Applied Arts and Technology Act 2002 (Government of Ontario, 2002). Under the Act all colleges must have mechanisms in place to ensure program consistency and quality. One of these mechanisms is the program review process. Two of the deans mentioned that they use the recommendations which arise from the program reviews to implement changes to the curriculum.

The program review generates detailed retention and attrition data at the program level, as well as identifying curriculum issues that need corrective action. The faculty provide most of information for the program reviews and one of the deans sees the review process as being an important means of informing faculty of issues in the programs. Faculty, especially the Program Coordinators, have an active role in student advising and need to have a good knowledge of the curriculum and which courses are the most problematic for students. The information that arises during the program review provides the faculty with the data they need to understand how the students are doing in their programs.

Access to program data is therefore not only a program quality assurance mechanism but a student retention strategy. College C has Program Dashboards that have all the retention and attrition data and course metrics for each program. These are available for faculty to review their programs. College M has a new database tool which provides program retention data for programs over several years.

All of the preceding strategies were linked to college-wide student retention strategies at each college. The second research question sought to determine what strategies the deans had implemented in their own schools, and would be unique to that school and it's engineering technology students. These strategies were identified by the themes which arose during the

analysis of the answers provided by the deans to the interview questions. These themes are summarized in the discussion following the two interview questions.

**Research Question #2:** Which student retention strategies are proving successful for engineering technology students?

This purpose of this question was to determine successful strategies the deans had implemented in their schools. This research question was linked to both Interview Questions #1 and #2:

1. What retention strategies have been tried in the academic school for students in engineering technology programs?
2. Which strategies have shown potential, or have proven effective, in increasing student persistence?

Again the themes of student success strategies identified by the deans were the ones that they thought were working to increase student retention in their schools. They did not identify anything that they had tried and which failed to have a positive influence on student retention. Their responses identified five themes of successful student success strategies. Each of these five strategies was offered by at least two, and sometimes three, of the deans. These themes are: Early Intervention, Course Recovery, Faculty Professional Development, Industry Connections and Pre-enrolment Activities. Each of these five strategies will be discussed in the following sections.

**Early Intervention**

College M and College C described an Early Intervention strategy as important for the success of the students. Early intervention is the process of doing assessments within the first few weeks at the start of the semester to determine how the students are doing in a course. Both

of these colleges have a mechanism in place to identify students who are not doing well or missing the assessments completely and then to refer them to the student advisor for follow-up. Even with the theme of early intervention identified as a success strategy, there are students who will not be able to pass a course and will need to make up or recover from missed or failed courses.

**Course Recovery**

Course recovery opportunities for students were identified by two colleges. These recovery mechanisms are program courses offered outside of the regular delivery schedule to allow students to repeat a course that they have failed or missed. These courses may be offered through the continuing education department and/or scheduled during the summer semester. In some instances the courses are offered in a compressed format in the May/June time period when full-time faculty are available to teach them. College C identified this as an excellent strategy for International students in the third and final year of their program. If they are missing a course they can take it in May-June and still graduate in the spring convocation. However, faculty also need to take courses or professional development seminars to understand the importance of student retention and the huge factor they themselves play in student success.

**Faculty Professional Development**

The theme of faculty arose from all three colleges. The faculty were acknowledged as playing an essential role in the success of the students. As one dean mentioned, faculty are "the front line". It is very important that the faculty realize their roles and responsibility for student retention and success. Each college provides various professional development opportunities for the faculty to learn about student retention. Engineering technology faculty in particular are encouraged to understand that eliminating poor performers is no longer the environment the

school wants to encourage. The classroom has changed from one of weeding out the poor performers to one of keeping students and meeting the learners wherever they are in the continuum of learning. Professional development strategies for faculty vary from workshops on teaching strategies and retention, to faculty retreats focused on retention to one-on-one discussions with faculty on assessment strategies.

College C has identified Flexible Program Delivery in their Academic Plan as a strategy to support students. Faculty are encouraged to see how they can re-package courses to give the students an opportunity to acquire knowledge in different modes and in different venues.

Delivery of the curriculum in the classroom is important and one college has recently hired an instructional support person to act as a resource for contract faculty. They conduct class visits to observe and mentor the faculty on their teaching styles. Contract faculty are often part-time faculty who are also working in industry.

**Industry Connections**

The opportunity to connect students with employers or industry was another theme identified by two colleges as a key student retention strategy. College F coordinates with a local industry association that sponsors a large barbecue complete with tents where all of the construction program students have the opportunity to meet with industry representatives to learn about careers in the construction industry. This event also provides a social opportunity for senior students to mix with new students, and for faculty, students and employers to mix. A similar career focused orientation is also organized by the manufacturing programs at this college. For the more specialized and newer program areas there are strong affiliations with professional associations in those areas.

College M organizes an industry sponsored Meet-the-Grad Night where employers, grads and industry reps are on the college campus to provide information on careers and jobs related to the engineering technology programs.

Both colleges encourage employers and industry reps to come on campus throughout the year to participate in smaller events such as industry panel sessions, lunch-n-learns and guest speakers in the classes. Although the campus activities are important, if students are prepared for their program before they arrive on campus they will have a better chance of success.

**Pre-enrolment Activities**

The theme of pre-enrolment activities carried out before the program starts was identified by two colleges as a success strategy that helps prepare new students academically for the rigor of the technology programs. College F invites admitted students to a one-day orientation in the summer. College M offers a pre-enrolment Assessment for Success initiative for all the students who have been accepted into the College in mathematics and English. If a student does well in the English assessment they could receive an exemption for the first semester Communications course required in their program. The math assessment enables the student to know if they have the math skills needed for the program. If they need some preparation before starting the program the college offers a summer math boot camp for all incoming technology students. The boot camp is offered at no cost to the students.

All of the above strategies (Pre-enrolment activities, Industry Connections, Faculty Professional Development, Course Recovery, Early Intervention) were common to two or three of the colleges. But the deans also identified individual themes or strategies that were unique to their own institution. These unique strategies are identified below.

**Unique Strategies**

College F has a new focus on ensuring prospective students choose the right program - that the program fit is right for the student. This theme is in some ways similar to career advising before the student starts the program. The college has detailed program information on the website, linked to the connecting career.

This college has also recently rebranded their website and launched a Your Story Campaign. This motivational campaign aims to encourage students to finish their program and showcases personal success stories that students can relate to. It engages students in understanding their career, finding their own pathway and defining their own success story.

College F also provides mentoring and supports for the female students in the engineering technology programs. The dean organizes a lunch-n-learn for all of the female students early in the semester. The dean hosts the lunch, which is also attended by the Student Advisor. The Women in Aviation industry association is a special partnership for those students enrolled in the aviation programs.

College C is currently piloting an e-textbook initiative in one course. The e-text format ensures that every student in the class has the textbook available to them on-line. The text comes with a rich database of digital support material and the faculty use the text as a resource in the classroom.

College C referenced the college Academic Plan when deciding to launch activities to support students in their programs. The Academic Plan highlights retention, pathways to learning and meeting learners where they are. The Dean stated that student retention "is a real focus, certainly in our academic plan, on where we want to go moving forward".

College M has a unique early intervention that occurs in one cluster of engineering technology programs before the Christmas holiday break. Just before the end of the semester, and before final exams, the program coordinator and the Associate Dean meet with the first semester students. They advise the students that they may recommend a transfer from the technology program to the technician program, or a transfer to a foundational program, if the student is not successful in the first semester. The messaging is delivered in such a way that it is positive and encouraging for the students. Following the promo meetings unsuccessful students are pre-registered into the other program and seamlessly transferred when they arrive back on campus in January. This is a more positive and pro-active approach to keeping a student enrolled at the college than sending them a notice that they have been unsuccessful and will be withdrawn from the program. Thus there were many themes that were identified by the deans around student success strategies.

**Summary**

All of the participants answered the interview questions with sincere reflection and honesty. The deans had a very good knowledge of student retention and easily identified the successful retention strategies they had implemented in their own schools. They also identified the college wide strategies that seemed to be effective for the engineering technology students. Although the questions were open ended to enable both successful and unsuccessful strategies to be identified, the deans did not identify any strategies that were not effective in increasing student retention.

When the data was analyzed it showed that there were many student retention themes

common to all three colleges. However there were also unique strategies to each college which could relate to the specific characteristics of the students in that college or the particular community and economic conditions around the college.

A complete discussion of the meanings and implications of these findings, and recommendations for further research are presented in Chapter 5.

# Chapter 5: Discussion, Conclusions and Recommendations

This chapter begins with a summary of the problem statement, brief overview of the research methodology, and key success categories identified in the literature review. The research findings are compared to the literature research in the Discussion section. The final two sections outline the limitations of the study and provide the researcher's conclusions and recommendations based on the findings of the research. The summary follows below.

## Summary

This study acknowledged the need for more college educated graduates to enter the workforce now and in the future (Miner, 2010). The jobs of the future will require higher skill levels than ever before as we move to a knowledge and skills based economy. Evidence of this need is already being seen in the skill shortages identified by Rick Miner in his report entitled: People without Jobs, Jobs without People and restated in his 2014 report entitled: The Great Canadian Skills Mismatch: People Without Jobs, Jobs Without People and More (Miner, 2010, 2014). Increasing the graduation rate in colleges is one way to meet the economic demand for more skilled graduates.

The overall graduation rate for colleges in 2014 was 65.8% (Colleges Ontario, 2015). But the graduates who are best prepared to meet the skills demand of the future are the engineering technology graduates. The graduation rate amongst this group of programs is at or below the college average (P. Van Horne, personal communication, January 11, 2016).

Ontario colleges are aware of this need to increase their graduation rates and have implemented various student success strategies to increase student retention. However, there does not appear to be any universally proven and adapted strategies identified by the colleges or in the literature that work for all college students (Tinto, 2012).

The student body at any college is comprised of students enrolled in many different programs. Each program group could be identified as a unique group of students. Tinto identified that some student success strategies may work far better than others for certain groups of students (1993). The focus of this study was to identify those student success strategies that may be working for the group of students enrolled in engineering technology programs in the Ontario colleges.

The study asked two research questions to determine the student success strategies. The participants were three college deans of engineering technology programs. The deans were chosen because they are senior administrators with a good understanding of student retention. They know what strategies have been implemented by their college and by their own schools. The research questions were:

- What retention strategies have been implemented at your college?
- Which retention strategies are proving successful for engineering technology students?

The deans of college engineering technology schools were interviewed because they have a broad knowledge of the student success strategies offered by their colleges, and by their own schools. They understand the engineering technology students and the challenges they face in the programs.

After interviewing the deans the data collected from the interviews was analyzed and coded. The repeated use of key words or phrases during the analysis of the transcripts led to the development of themes, or categories, of success strategies. Some of the themes were common to all three deans, some were common to two deans, and some themes were unique to one dean. These themes were compared to the student success strategies identified in the literature review. The literature review strategies fell within eight categories: the Classroom Experience (Tinto,

2012; Pascarella & Terenzini, 2005), Active Learning (Christie, 2013), Mentoring (Christie, 2013; Kuh et al., 2005; University of Arizona, 2007), Advising (Tinto, 2012; Kuh et al., 2005; Pascarella & Terenzini, 2005), Research (Christie, 2013; Pascarella & Terenzini, 2005; Graham et al., 2013), Freshman Seminar and Orientation (Braxton, 2014; Lim, et al., 2014), Learning Communities (Kuh et al., 2005; Bailey & Alfonso, 2005) and Supplemental Instruction (Pascarella & Terenzini, 2005; Hadsell et al., 2014). A detailed comparison of the themes which arose from the data to the literature review categories follows below in the discussion.

**Discussion**

The research was focused on identifying success strategies for engineering technology students. The following discussion is centered on the study's two research questions:

1. Which retention strategies have been implemented at your college?
2. Which retention strategies are proving successful for engineering technology students?

The deans identified the strategies that were successful and did not identify any strategies that had been implemented but which did not appear to be showing signs of success. The themes, or categories, which emerged from the data analysis and identified in Chapter 4: Data Analysis and Results were compared with the categories of student retention strategies identified in the literature review.

The comparison of the strategies in the literature review and the strategies identified by the deans is shown in Table 1: Comparison of Student Retention Strategies Identified by the Deans to those Identified in the Literature Review. The eight categories from the literature are: The Classroom Experience (Tinto, 2012; Pascarella & Terenzini, 2005), Active Learning (Christie, 2013), Mentoring (Christie, 2013; Kuh et al., 2005; University of Arizona, 2007), Advising (Tinto, 2012; Kuh et al., 2005; Pascarella & Terenzini, 2005), Research (Christie, 2013;

Pascarella & Terenzini, 2005; Graham et al., 2013), Freshman Seminar and Orientation (Braxton, 2014; Lim, et al. 2014), Learning Communities (Kuh et al., 2005; Bailey & Alfonso, 2005), and Supplemental Instruction (Pascarella & Terenzini, 2005; Hadsell et al., 2014).

Table 1

*Comparison of Student Retention Strategies Identified by the Deans to those Identified in the Literature Review*

| | Strategies Identified in the Literature | Strategies Identified by the Deans | | |
|---|---|---|---|---|
| | | College Wide* | School Specific** | Unique to the Dean*** |
| 1 | Classroom experience | All faculty responsible for their classroom | Faculty Professional Development | |
| 2 | Active Learning | | Faculty Professional Development | |
| 3 | Mentoring | | | College F – mentoring female students |
| 4 | Advising<br>• Academic<br>• Career | Student Advisors | Early Intervention<br>Industry Connections | College M – redirection of Semester 1 students<br>College F – Program FIT |
| 5 | Research | | | |
| 6 | Freshman Seminar and Orientation | New Student Orientation<br>Fall Engagement Week | Pre-enrolment Activities | |
| 7 | Learning Communities | | | |
| 8 | Supplemental Instruction | Math Support | Course Recovery | |
| | | Curriculum Quality Assurance | | College F – Your Story Campaign |
| | | | | College C – Academic Plan |
| | | | | College C – e-textbooks |

Note: *College Wide Strategies offered for all students, by central College departments such as Student Services **School Specific strategies identified by 2 or 3 of the Deans ***Unique strategies by 1 Dean

The first category in Table 1 is the Classroom Experience. The deans were unanimous in acknowledging the importance of the faculty in setting the climate or environment in the classroom. One dean went so far as to identify faculty being in the front lines with the students. The deans have implemented Professional Development (shown in Table 1) for their faculty to increase their understanding of the importance of student retention and their role in setting a positive learning environment in their classrooms. The learning environment is also impacted by the delivery strategies used by the faculty.

The second strategy identified in Table 1 and the literature was a course delivery strategy called Active Learning. Active Learning has been identified as a strategy that increases student retention because it actively engages students in their own learning (Braxton et al., 2014). Although the deans did not identify Active Learning as a specific student success strategy, they did identify the value of good teaching and course delivery to the student's understanding of the course material. Faculty are encouraged to keep current on teaching methods through Professional Development. Opportunities for Professional Development are provided by both the College in a centralized Teaching and Learning Centre and by the school itself. Thus Professional Development is listed as both a College Wide and School Specific strategy in Table 1.

Course delivery is so important that one college has hired an instructional support person to act as a resource for contract faculty, who may not be able to access the centralized college supports (commonly known as the Centre for Teaching and Learning). This person could also be a mentor for the faculty, who appreciate mentorship as much as their students do.

Mentoring was the third strategy from the literature review listed on Table 1 and was identified by one dean as important for students in technology programs. Mentorship has shown

in the literature to be effective for first year minority students (Upcraft et al., 2005). The dean of College F makes a special effort to connect with the women students, who are in the minority compared to their male counterparts in aviation related programs. Faculty members are also encouraged to join the students in attending industry events and professional association activities outside the classroom.

Advising is the fourth strategy in Table 1 and has both Academic and Career sections. Advising was identified in the literature and by the deans as being important for student success. All three deans have implemented academic advising in their schools and academic advising is also a college wide student success strategy. Along with academic advisors two deans had implemented early assessments of the students as a tool to help the faculty and the academic advisors identify students at risk within the first seven weeks of the semester start. College M advises, or redirects, students to alternate programs at the end of the first semester when it appears they will be unsuccessful in their chosen program. This is done in a very encouraging and positive way, by the advisor and the faculty.

There was also evidence in the literature on the importance of Career Advising (Upcraft et al., 2005) and College F has recently implemented an online strategy to advise prospective students on the career and the matching program that is best suited to them before they enroll.

In order to help students gain clarity around their career goals, informal career advising occurs during industry events on campus. College F and College M schedule many events on campus to bring industry and students together. There was a gap in the literature on this value of informal career advising.

The sixth student retention strategy from the literature review in Table 1 is the Freshman Seminar and Orientation. Although the freshmen seminar and orientation were usually grouped

together in the literature, the orientation for new students was also identified as an important student retention strategy on it's own (Braxton, 2014). The deans focused on the value of the incoming student orientation for their students**.**

All three colleges had orientations, but two of the deans augmented the orientation with events and activities directed towards their own students. One dean focused on career and industry networking events, the other on an extended orientation over several weeks to provide students with information on college supports as well as careers related to their programs. Once the students have started their program, they may need additional support to succeed in the courses. One such support mechanism is known as supplemental instruction.

Supplemental instruction (SI) is listed as the eighth success strategy in Table 1. SI is a "peer assisted academic support program implemented to reduce high rates of attrition, increase the level of student performance in difficult courses, and increase graduation rates" (Upcraft et al., 2005). It is a very specific strategy where students who have successfully passed a difficult course retake the course with junior students in order to provide the junior students with assistance (Upcraft et al., 2005).

The deans did not identify SI itself but they did have several strategies to support students in challenging courses. These strategies are listed separately in Table 1 as Math Support in the College Wide column and Course Recovery in the School Specific column.

Mathematics is a difficult course for many students. All three colleges had a central learning and resource center for mathematics support. Two of the schools also offered additional math assistance to their students. One college offered something similar to SI when they hired senior students to attend math classes with the first year students and follow-up with tutorial

sessions. The second college had engineering technology program faculty voluntarily staffing their own math resource center.

Course recovery strategies help students continue in the program even if they have failed a course. Two colleges offer summer semester make-up courses and courses delivered through the Continuing Education department. One school offers compressed format courses in May and June taught by the full time program faculty. These courses are specifically scheduled and designed to enable students to graduate in June. These types of strategies which were offered by the schools were not identified in the literature and seem to be unique for the engineering technology students.

There were three strategies identified by the deans that did not match the literature review in Table 1. These strategies were: Curriculum Quality Assurance, Academic Plan and a Marketing Campaign called Your Story.

The theme of good curriculum, or Curriculum Quality Assurance, was not identified in the literature, but it was important at all three colleges. One college has an Academic Plan that clearly identifies good programming and student retention as important. This plan serves as a guide to the institution on the direction of programs and student success. Marketing was the final theme unique to a dean and there was no mention of marketing in the literature review as a student success strategy. Marketing was used by College F to inform students of the careers related to their program and also gave students the opportunity to tell their own student success story. The story of why they chose to take a program and what they seem themselves doing when they graduate.

There were also two strategies identified in the literature that were not mentioned by any of the deans: Research (Christie, 2013; Pascarella & Terenzini, 2005; Graham et al., 2013) and

Learning Communities (Kuh et al., 2005; Bailey & Alfonso, 2005). However , the interview time for the data collection was only one hour and there may have been student success themes that the deans did not have time to describe. The short interview time is one of the limitations of the study. Additional limitations are outlined in the section below.

**Limitations**

The first limitation of the pilot study was the small sample size--three of a total of 24 colleges in Ontario were sampled. These colleges were large, urban and within a two-hour drive of the GTA. The study was limited in its' ability to generalize the results because of the diversity of the colleges within the Ontario system. Colleges in Ontario vary in size from very small to large, and are located in rural as well as urban settings. The findings indicate that there are student success strategies that seem to be working for the three colleges sampled, but more research is needed for all the colleges. The sample size was restricted due to the time limits of the research. The time limit also restricted the number of interview questions.

The second limitation of the study was its' ability to compare the study results to the student success strategies identified in the literature. There is a gap in the literature regarding Canadian, particularly Ontario data. However, there were some College wide strategies that were common to all institutions and all students.

The researcher was a dean and in the same position as the participants. Some researcher bias may have existed, even though every effort was made to remain neutral and unbiased when asking the interview questions and interpreting the results.

**Conclusions**

The literature and the research aligned well in four areas identified above: Classroom Experience, Active Learning, Advising, and Freshman Seminar and Orientation. The deans did

not identify strategies in the areas of Research or Learning Communities. This could have been for many reasons including the one-hour length of the interview, lack of the specific activity in the college and/or school or simply because it was not top of mind at that time. There was also the possibility that they were not success strategies for the students at this time.

However, there was no shortage of overall activity around student success. The deans identified many strategies that were provided to the students by the colleges and schools themselves, some of which fell into the literature review categories and some of which were unique. The unique strategies are listed in Table 1: e-textbooks, College Academic Plan and the importance of good curriculum to student success (Curriculum Quality Assurance).

The purpose of the pilot study was to identify student success strategies for engineering technology students. Table 1 lists the student retention strategies identified by the deans and offered both at the college wide level and the school specific level. Therefore the research questions were answered:

Research Question 1: What retention strategies have been implemented at your college?

Research Questions 2: Which student retention strategies are proving successful for engineering technology students.

The deans did not mention any strategies that were tried and found to be ineffective.

**Recommendations**

As a result of analyzing the research data and comparing the data to the literature review the researcher has made the following recommendations:

1. Expand the pilot study to all of the colleges with engineering technology students. The findings of this study have shown that there are several strategies that seem to be working for engineering technology students in three colleges. Data collected from all colleges

with engineering technology programs may confirm which student success strategies are best suited for these students.

2. Analyze quantitative data on student retention to validate the strategies that the deans identified as being successful at retaining students in the programs.
3. Conduct additional research on student success in Ontario colleges. Most of the literature was on US colleges and universities. There are gaps in the existing research in the area of student success strategies at Ontario colleges and this research could begin to fill in the gaps.

This study identified that there is a gap in the amount of literature available on student success strategies in Ontario colleges, and in particular for engineering technology students. Graduates of these programs will be needed to fill the skills gap of the future, so it will be increasingly important to ensure as many students as possible who start the programs graduate. But the colleges, in particular the deans, are focused on student success, and this is reflected in the number of student success strategies they have implemented for their students. There may be more student success strategies than were identified in this small sample size of colleges.

## References

American Society for Engineering Education (2012, August 22). *Going the distance: Best practices and* strategies for retaining engineering, engineering technology and computing students. Retrieved from https://www.asee.org/retention-project

Arizona State University (2007, July 2). Failing the future: Problems of persistence and retention in science, technology, engineering, and mathematics (STEM) majors at Arizona State University. Retrieved from http://pat-thompson.net/PDFversions/2007FSICfinalreport.pdf

Astin, A. W. (1984). Student involvement: A developmental theory for higher education. *Journal of College Student Development*, *40*(5), 519-529.

Bailey, T. R. & Alfonso, M. (2005, January). *Paths to persistence: An analysis of research on program effectiveness at community colleges.* Retrieved from http://ccrc.tc.columbia.edu/publications/paths-to-persistence.html

Braxton, J. M., Doyle, W. R., Hartley III, H. V., Hirschy, A. S., Jones, W. A., & McLendon, M. K. (2013). *Rethinking college student retention*. San Francisco, CA: Jossey-Bass.

Cabrera, A., Colbeck, C., Terenzini, P. (1998). Teaching for Professional competence: Instructional practices that promote development of group problem solving and design skills. Proceedings from the *Annual Meeting of the Association for the Study of Higher Education.* Miami,FL

Central Michigan University (2015, July 1). *Master of arts in education: Guide to the capstone*. Retrieved from http //libguides.cmich.edu/gcls/mae_resources?hs=a&gid=4014

Christie, B. (2013). The importance of faculty-student connections in STEM disciplines: A literature review. *Journal of STEM Education, 14*(3), 22-26.

Colleges and Institutes Canada (2015). *The college and community innovation program: Partnerships for industry innovation.* Retrieved from http://www.collegesinstitutes.ca/file/the-college-and-community-innovation-program-partnerships-for-industry-innovation

Colleges Ontario (2015). *Environmental scan: Student and graduate profiles*. Retrieved from http://collegesontario.org/research/2014_environmental_scan/CO_EnvScan_2015_PROFILES_WEB.pdf

Colleges Ontario (2014). *Environmental Scan: Student and Graduate Profiles*. Retrieved from http://collegesontario.org/research/2014_environmental_scan/CO_EnvScan_2014_PROFILES_WEB.pdf

Colleges Ontario (2014). *Key Performance Indicators*. Retrieved from http://collegesontario.org/outcomes/key-performance-indicators/2014-15_KPI_English_updated.pdf

Creswell, J. W. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*. Boston, MA: Pearson.

Crown, S., Fuentes, A., Tarawneh, C., Freeman, R. & Mahdi, H. (2009). Student academic advisement: Innovative tools for improving minority student attraction, retention, and graduation. *Proceedings from the American Society for Engineering Education 2012 Annual Conference and Exposition.* San Antonio, TX.

Deloitte (2012, July). *Breaking down barriers*. Retrieved from http://www.collegesontario.org/research/external-reports/Deloitte%20Final%20Report%20%20July%202012.pdf

Felder, R. M., & Brent, R. (2005). Understanding student differences. *Journal of Engineering Education*, *94*(1), 57-72.

Graham, M., Frederick, J., Byers-Winston, A., Hunter, A-B. (2013). Increasing student persistence of college students in STEM. *Science Vol 341.* 1455 – 1456. Retrieved from http://www.fgcu.edu/STEM/files/Increasing_Persistence_of_College_Students_in_STEM .pdf

Hadsell, C., Burwell-Woo, C. & Enriquez, A. (2014). Programs to enhance retention and success of students enrolled in two-year college engineering programs. *Proceedings from the 2014 American Society of Engineering Educators Annual Conference and Exposition.* Indianapolis, IN.

Higher Education Quality Council of Ontario (HECQO), (2013, July). *Myth or fact*. Retrieved from http://www.heqco.ca/en-ca/postsecissues/mythorfact/Pages/default.aspx.

Kirby, D., Sharpe, D. (2001). Student attrition from Newfoundland and Labrador's public college. *The Alberta Journal of Educational Research*, *47*(4), 353-368.

Kuh, G., Cruce, T., Shoup, R., Kinzie, J., Gonyea, R. (2007). Unmasking the effects of student engagement on college grades and persistence. *Proceedings from the 2007 Annual meeting of the American Educational Research Associates.* Chicago, IL.

Kuh, G. D., Kinzie, J., Schuh, J. H., & Whitt, E. J. (2005). *Student success in college: Creating conditions that matter*. San Francisco, CA: Jossey-Bass.

LaRose, S., Cyrenne, D., Garceau, O., Harvey, M., Guay, F., Godin, F., Tarabulsy, G., Deschenes, C. (2011). Academic mentoring and dropout prevention for students in math, science and technology. *Mentoring & Tutoring: Partnership in Learning*, *19* (4), 419-439.

Lim, J.H., Tolley, P. A. Warren, K., Tkacik, P.T. (2011). The freshman engineering experience: Results from a mixed-method evaluation study. *Proceedings from the 2011 American Society of Engineering Educators Annual Conference.* Vancouver, BC. Retrieved from https://www.asee.org/public/conferences/1/papers/1316/view 2011

Miner, R. (2010). *People without jobs, jobs without people: Ontario's labour market future*. Retrieved from http://www.minerandminer.ca/data/Miner_March_2014_final(2).pdf.

Miner, R. (2014). *The great Canadian skills mismatch: People without jobs, jobs without people and MORE.* Retrieved from http://www.minerandminer.ca/data/Miner_March_2014_final(2).pdf

Munro D., Haimowitz, J. (2010, November), Innovation catalysts and accelerators: The impact of Ontario colleges' applied research. *Conference Board of Canada*. Retrieved from http://www.collegesontario.org/research/external-reports/innovation_catalysts_and_accelerators_report.pdf

Munro, D., Stucky, J. (2013). The need to make skills work: The cost of Ontario's skills gap. *Conference Board of Canada*. Retrieved from http://www.conferenceboard.ca/e-library/abstract.aspx?did=5563

Noel-Levitz (2013). Cost of recruiting an undergraduate student: Benchmarks for four-year and *two-year institutions.* Retrieved from https://www.ruffalonl.com/papers-research-higher-education-fundraising/2013/2013-cost-of-recruiting-an-undergraduate-student-report

Ohland, M. W., Sheppard, S. D., Lichtenstein, G., Eris, O., Chachra, D., & Layton, R. A. (2008). Persistence, engagement, and migration in engineering programs. *Journal of Engineering Education*, *97*(3), 259-278.

Ontario Colleges of Applied Arts and Technology Act (2002). Retrieved from https://www.ontario.ca/laws/statute/02o08f

Pascarella, E. T., & Terenzini, P. T. (2005). *How college affects students: A third decade of research*. 2nd edition, San Francisco, CA: Jossey-Bass.

Payne, T. (2015). What is a pilot study: Definition and Example. *Study.com* Retrieved from: http://study.com/academy/lesson/what-is-a-pilot-study-definition-example.html

Rushowy, K. (2014, June 10). Ontario college enrolment jumps. *Thestar.com*. Retrieved from: http://www.thestar.com/yourtoronto/education/2014/01/20/ontario_college_enrolment_jumps.html

Seidman, A. (2012). *College student retention: Formula for student success.* Lanham, MD: Rowman and Littlefield Publishing Group.

Seymour, E. (1992). "The problem iceberg" in science, mathematics, and engineering education: Student explanations for high attrition rates. *Journal of College Science Teaching*, *21*(4), 230-238.

Smith, K. A., Sheppard, S. D., Johnson, D. W., & Johnson, R. T. (2005). Pedagogies of engagement: Classroom-based practices. *Journal of engineering education*, *94*(1), 87-101.

Sutton, K. L., & Sankar, C. S. (2011). Student satisfaction with information provided by academic advisors. *Journal of STEM Education: Innovations and Research*, *12*, 71-85.

Tinto, V. (1975). Dropout from higher education: A theoretical synthesis of recent literature. *A Review of Education Research*, 45, 89-125.

Tinto, V. (1997). Colleges as communities: Taking research on student persistence seriously. *The review of higher education*, *21*(2), 167-177.

Tinto, V. (1998). Colleges as communities: Taking research on student persistence seriously. *The Review of Higher Education*, Volume 21(2), 167-177.

Tinto, V. (1999). Taking retention seriously: Rethinking the first year of college. *NACADA journal*, *19*(2), 5-9.

Tinto, V. (2004). Student Retention and Graduation: Facing the Truth, Living with the Consequences. Occasional Paper 1. *Pell Institute for the Study of Opportunity in Higher Education*.

Tinto, V. (2012). *Completing college: Rethinking institutional action.* Chicago, IL: The University of Chicago Press.

Upcraft, M. L., Gardner, J. N., Barefoot, B.O., & Associates (2005). *Challenging & supporting the first-year student: A handbook for improving the first year of college*. San Francisco, CA: Jossey-Bass.

Zhang, G., Anderson, T. J., Ohland, M. W., & Thorndyke, B. R. (2004). Identifying Factors Influencing Engineering Student Graduation: A Longitudinal and Cross-Institutional Study. *Journal of Engineering Education*, *93*(4), 313-320.

## Appendix A: Research Instrument

The research questions this project sought to answer were:

1. Which retention strategies have been implemented at your college?
2. Which student retention strategies are proving successful for engineering technology students?

The following questions were posed to the participants:

1. What retention strategies have been tried in the academic school for students in engineering technology programs?
2. Which strategies have shown potential, or have proven effective, in increasing student persistence?
3. Which strategies at the College level seem to be effective in increasing student persistence?

## Appendix B: CMU–RRA

CMU
CENTRAL MICHIGAN UNIVERSITY

RESEARCH REVIEW APPLICATION
FOR MSA 685/699 AND EDU 776 CAPSTONE COURSE PROJECT

Project title: Pilot Study of Student Success Strategies for Engineering Technology Students at Thr

Student name: Denise Devlin-Li Student ID#: 0000505967

E-mail address: devli2d@cmich.edu Work phone: 416-675-6622 ext 6131 Home phone: 905-861-9698

Concentration: MAE - Community College

Instructor's name: Dr. Michael Stacey Instructor e-mail: staceymj@cmich.edu

Course: EDU 776 EPN: 22262277 Program center: George Brown College

Do you intend to use human subjects or human subjects data in your project? Yes ☑ No ☐

Do you intend to publish your project or present project results outside of your organization? Yes ☐ No ☑

If you answered "yes" on both questions, you are required to complete CITI training and seek approval through CMU's Institutional Review Board (IRB). The IRB process requires registration in IRBNet and submission of your application materials and supporting documents through IRBNet. Please consult with your instructor and the appropriate program office for assistance.

If you answered "no" to one or both questions, you may use this form for your research review. Read the following directions:

| Non-human subject research | Human subjects research |
|---|---|
| In the box below describe the purpose of your research, describe the data you plan to use, and specify the sources of your data (URL, organizational source, etc.)<br>Required attachments: Permission letter on the organization's letterhead if the data is not available to the general public. | In the box below describe the purpose of your research; specify the source of your subject pool, the number of subjects, and the selection criteria. Specify your relationship to the subjects (co-worker, supervisor, work in same organization, etc.). Describe your research methodology.<br>Required attachments: Copy of survey or interview questions, cover letter or consent form, permission letter on the organization's letterhead if the subject pool is not selected from a public source such as a phone directory or web page. |

The purpose of this pilot qualitative study is to identify student retention strategies which have been cried at colleges and identify those which have shown to be successful for students enrolled in engineering technology programs in three Ontario colleges. The research questions are:
1. Which student retention strategies have been implemented at your college?
2. Which student retention strategies are proving successful for engineering technology students?
Background: Students on college campuses today are enrolled in many different fields of study and student retention is an issue in every field. There are many strategies offered by both the academic schools and other departments in the college that may increase student retention, but there is no consensus in the literature on any strategy which has proven to be universally effective. These strategies fall into several broad categories: the classroom experience, active learning, mentoring, advising, applied research, freshman seminar and orientation, learning communities and supplemental instruction. The strategies that work for some groups of students, such as design or business students may not work for engineering technology students. In a climate of fiscal restraint it is not possible to investigate all of the strategies and determine which ones work best for each group of student. There is very little research on retention strategies for engineering technology students.
Methodology: Deans will be contacted from three Ontario colleges. The researcher knows the deans from attendance at the Heads of Technology (HOT) meetings organized by Colleges Ontario. Once the deans have confirmed their interest in participating a semi-structured interview of about an hour will be scheduled with each participant. The Dean may designate an Associate Dean or Department Head to participate. The location will be at a site chosen by the participant. If a face-to-face meeting is not possible, the interview will be conducted by telephone. Interviews will be recorded to enable the researcher to accurately transcribe the responses for analysis.
Source of the subject pool: the colleges will be chosen from the list of public colleges identified on the Colleges Ontario website. The website of each college lists all employees and their contact information at the institution. The deans are known to the researcher (who is a Dean) through participation on the Heads of Technology (HOT) committee supported by Colleges Ontario, the umbrella organization for each publically funded college in Ontario.
Confidentiality: participants will be identified as Senior Administrator College 1, 2, or 3. The face-to-face interviews will be held in a location of the participant's choice and recorded. The data will be transcribed. All files will be password protected and the transcribed files will be encrypted.
The results will be shared amongst the interviewees but the identity of the interviewees will be kept confidential. The individual colleges will not be identified.
Number of subjects: 3
Selection criteria: Deans from three colleges close to the researcher's home college will be chosen. This is a pilot study so the need for a representative sample of college deans is not necessary.
Risk: Minimal or low to participants. The participants will be asked questions relating student success strategies at their college. All participants are senior level administrators who understand what information may be confidential for their own organization and are well aware of the research ethics process.
There is very low risk of harm for any participant. They will be asked questions and can refuse to answer any question at any time, or withdraw from the research at any time. This will be stated on the consent letter they sign before the start of the interview. The research is qualitative and data will not be analysed statistically.
Once the data has been transcribed and coded, the participant will have the opportunity to review the information they have provided, and discuss it if appropriate.
All electronic files will be stored on a computer in the researcher's office, which is locked. The computer itself is password protected. Files will be password protected and encrypted. A password protected usb will also be used. After one year all electronic files will be destroyed.

Routing: Student, Instructor, Program Office, Notification to Student/Instructor, Document Imaging/SLCM Coding Page 1

## Appendix B (cont'd): CMU–RRA

CMU
CENTRAL MICHIGAN UNIVERSITY

*Please check all that apply:*

☑ My project is work-related ☐ My project is related to my concentration ☐ My project is not related to my work or to my concentration. Please provide a rationale for a project that is not work-related or concentration-related:

**Directions:** Insert digital signature or type in your name as verification/approval of the information presented in this application. Your signature also confirms your commitment to appropriate research ethics while conducting this research: Submit this form and applicable attachments to your instructor. Please wait for written approval prior to beginning data collection.

Student signature: Denise Devlin-Li Date: October 5, 2015

Student signature: Denise Devlin-Li Date: October 5, 2015
*(Please type or print your name.)*

Instructor signature: Michael J. Stacey Date: 10/6/2015

Instructor signature: Michael Stacey Date: 10/6/2015
*(Please type or print your name.)*

Program approval signature: Jahzara Mayes Otoo Date:

Program approval signature: Preliminary approval pending RSB a Date:
*(Please type or print your name.)*

Routing: Student, Instructor, Program Office, Notification to Student/Instructor, Document Imaging/SLCM Coding Page 2

## Appendix C: College C REB

Denise Devlin-Li
6 Cypress Point Court.
Thornhill. ON

October 20, 2015

**REB application # 245: Pilot study of student success strategies for Engineering Technology students at three Ontario Colleges**

Dear Denise;

The [redacted] College Research Ethics Board involving Human Subjects has reviewed your ethics review application and documentation and grants approval for the above-named study. The approval is based on the following:

1) The [redacted] REB must be informed of any protocol modifications as they arise
2) Any unanticipated problems that increase risk to the participants must be reported immediately
3) You have one year approval for the study: if needed, an annual renewal form will be required at that time
4) A study completion form is submitted upon completion of the project.

These forms can be downloaded from the [redacted] College ethics website:
http://www.centennialcollege.ca/applied/ethics/submitapplication

On behalf of the committee at [redacted] I'd like to wish you every success with your project.

Sincerely,

Chair
Research Ethics Board involving Human Subjects

## Appendix C: College F REB

### College Research Ethics Board Review

**Approval Notification of Proposed Research**
***Involving Human Participants at [redacted] College***

| | |
|---|---|
| **Protocol Number:** | 15-10-13-1 |
| **Principal Researcher(s):** | Denise Devlin-Li |
| **Research Protocol Title:** | Pilot Study of Students Success Strategies for Engineering Technology Students at Three Ontario Colleges |
| **Research Project Start Date:** | October 15, 2015 |
| **Expected date of termination:** | February 28, 2016 |
| **Documents Reviewed:** | Protocol; Research Instrument; Consent Form; Invitation Email |

Based solely on the ethical considerations raised by the research proposed in the application, the Research Ethics Board has completed its Delegated Review of the above Research Proposal and **Approved** the Project on October 29, 2015.

**Comments and Conditions:**

Please note that the REB requires that you adhere to the protocol reviewed and approved by the REB. The REB must approve any modifications to the protocol before they can be implemented.

Researchers must report to the REB:
a) any changes which increase the risk to the participants;
b) any changes which significantly affect the conduct of the study;
c) all adverse and/or unexpected experiences in the course of carrying out the study;
d) any new information which may adversely affect the safety of the participants or the conduct of the study.

Researchers must submit an REB Amendment/Extension form annually for all ongoing research projects. In addition, researchers must submit an REB Annual Review/Status Update form at the conclusion of the project.

**ETHICS APPROVAL DOES NOT CONSTITUTE PERMISSION TO CONDUCT THE RESEARCH, AND APPROVAL FOR CONDUCTING THE PROJECT MUST BE OBTAINED FROM THE DEAN OF THE FACULTY IN WHOSE AREA THE RESEARCH WILL TAKE PLACE, OR IN THE CASE OF COLLEGE WIDE SURVEYS THE OFFICE OF INSTITUTIONAL RESEARCH AND PLANNING.**

Members of the who are named as investigators in research studies, or declare a conflict of interest, do not participate in discussion related to, nor vote on, such studies when they are presented to the

October 29, 2015

Chair, REB

Date

## Appendix C: College M REB

[redacted] COLLEGE

# Research Ethics Board
# CERTIFICATE OF APPROVAL

| PRINCIPAL INVESTIGATOR | DEPARTMENT | NUMBER |
|---|---|---|
| Denise Devlin-Li | MA, Education at Central Michigan University<br>Dean, School of Applied Technology, Humber | 15-020-C |

[redacted] RESEARCH WILL BE CARRIED OUT:
Department of Engineering Technology

FACULTY ADVISOR (If student research):
Mike Stacey

SPONSORING AGENCIES:
NA

TITLE:
Pilot Study of Student Retention Strategies in Engineering Technology Programs

| APPROVAL TYPE: | APPROVAL DATE: | APPROVAL PERIOD (YEARS): | COMPLETION REPORT/ RENEWAL DUE DATE: |
|---|---|---|---|
| DELEGATED ☐<br>FULL ☒ | October 27, 2015 | 1 Year | October 27, 2016 |

CERTIFICATION

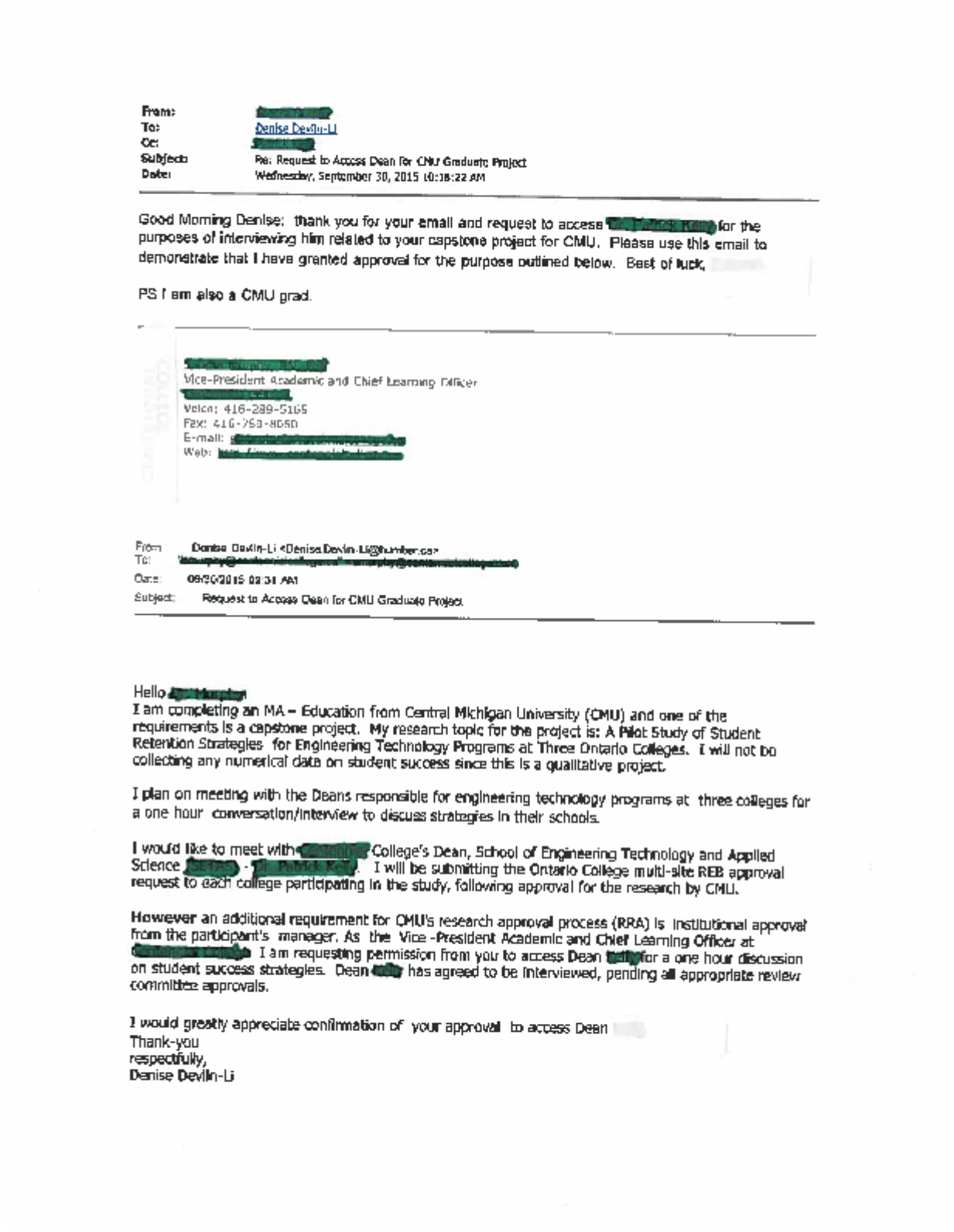
The protocol describing the above-named project has been reviewed by the College Research Ethics Board and the procedures were found to be acceptable on ethical grounds for research involving human subjects.

*Approval of the Research Ethics Board by:*

*Chair*

*This Certificate of Approval is valid for the term indicated provided there is no change in the experimental procedures.*

Appendix D: College C VPA Approval



From: [redacted]
To: Denise Devlin-Li
Cc: [redacted]
Subject: Re: Request to Access Dean for CMU Graduate Project
Date: Wednesday, September 30, 2015 10:38:22 AM

Good Morning Denise: thank you for your email and request to access [redacted] for the purposes of interviewing him related to your capstone project for CMU. Please use this email to demonstrate that I have granted approval for the purpose outlined below. Best of luck,

PS I am also a CMU grad.

[redacted]
Vice-President Academic and Chief Learning Officer
[redacted]
Voice: 416-289-5165
Fax: 416-753-8050
E-mail: [redacted]
Web: [redacted]

From: Denise Devlin-Li <Denise.Devlin-Li@humber.ca>
To: [redacted]
Date: 09/30/2015 09:31 AM
Subject: Request to Access Dean for CMU Graduate Project

Hello [redacted]
I am completing an MA – Education from Central Michigan University (CMU) and one of the requirements is a capstone project. My research topic for the project is: A Pilot Study of Student Retention Strategies for Engineering Technology Programs at Three Ontario Colleges. I will not be collecting any numerical data on student success since this is a qualitative project.

I plan on meeting with the Deans responsible for engineering technology programs at three colleges for a one hour conversation/interview to discuss strategies in their schools.

I would like to meet with [redacted] College's Dean, School of Engineering Technology and Applied Science [redacted]. I will be submitting the Ontario College multi-site REB approval request to each college participating in the study, following approval for the research by CMU.

However an additional requirement for CMU's research approval process (RRA) is institutional approval from the participant's manager. As the Vice-President Academic and Chief Learning Officer at [redacted] I am requesting permission from you to access Dean [redacted] for a one hour discussion on student success strategies. Dean [redacted] has agreed to be interviewed, pending all appropriate review committee approvals.

I would greatly appreciate confirmation of your approval to access Dean [redacted]
Thank-you
respectfully,
Denise Devlin-Li

## Appendix D: College F VPA Approval

**From:** [redacted]
**To:** Denise Devlin-Li
**Subject:** RE: Request to Access Dean of Technology
**Date:** Wednesday, September 30, 2015 3:34:50 PM

Hi Denise – nice to hear from you.
You absolutely have my approval to contact [redacted] I can give [redacted] a heads up if you like. [redacted] a great person (just like you).
I had to get REB approval from every college last summer for my PhD study – not fun.

Hope all is well with you – and take care.

[redacted]

Senior Vice President Academic

Office of the Vice President Academic

[redacted]

**From:** Denise Devlin-Li [mailto:Denise.Devlin-Li@humber.ca]
**Sent:** Wednesday, September 30, 2015 9:23 AM
**To:** Lima, Gary <glima@fanshawec.ca>
**Subject:** Request to Access Dean of Technology

Hello [redacted]
I am completing an MA – Education from Central Michigan University (CMU) and one of the requirements is a capstone project. My research topic for the project is: A Pilot Study of Student Retention Strategies for Engineering Technology Programs at Three Ontario Colleges. I will not be collecting any numerical data on student success since this is a qualitative project.

I plan on meeting with the Deans responsible for engineering technology programs at three colleges for a one hour conversation/interview to discuss strategies in their schools.

I would like to meet with [redacted] Dean, Faculty of Technology - [redacted] I will be submitting the Ontario College multi-site REB approval request to each college participating in the study, following approval for the research by CMU.

However an additional requirement for CMU's research approval process (RRA) is institutional approval from the person's manager. As the Senior Vice -President Academic Services at [redacted] College I am requesting permission from you to access Dean [redacted] for a one hour discussion on student success strategies. Dean

## Appendix D: College M VPA Approval

From:
To: Denise Devlin-Li
Subject: RE: Request to Interview Dean of Technology Programs
Date: Wednesday, September 30, 2015 9:47:33 AM

Denise, I support you interviewing [redacted]. Nice to hear from you,

[redacted]
Vice President, Academic

From: Denise Devlin-Li [mailto:Denise.Devlin-Li@humber.ca]
Sent: September 30, 2015 9:42 AM
To: [redacted]
Subject: Request to Interview Dean of Technology Programs

Hello [redacted],
I am completing an MA – Education from Central Michigan University (CMU) and one of the requirements is a capstone project. My research topic for the project is: A Pilot Study of Student Retention Strategies for Engineering Technology Programs at Three Ontario Colleges. I will not be collecting any numerical data on student success since this is a qualitative project.

I plan on meeting with the Deans responsible for engineering technology programs at three colleges for a one hour conversation/interview to discuss strategies in their schools.

I would like to meet with [redacted] College's Dean, Engineering Technology, Media and Entertainment - [redacted]. I will be submitting the Ontario College multi-site REB approval request to each college participating in the study, following approval for the research by CMU.

However an additional requirement for CMU's research approval process (RRA) is institutional approval from the participant's manager. As the Vice-President Academic at [redacted] College I am requesting permission from you to access Dean [redacted] for a one hour discussion on student success strategies. Dean [redacted] has agreed to be interviewed, pending all appropriate review committee approvals.

I would greatly appreciate confirmation of your approval to access Dean [redacted].
Thank-you
respectfully,
Denise Devlin-Li
graduate student - Central Michigan University (CMU)

## Appendix E: Letter of Informed Consent

CMU
CENTRAL MICHIGAN UNIVERSITY

Consent  Informal Personal Interview

Month, date, 2015

Hello:

My name is Denise Devlin-Li and I am a graduate student at Central Michigan University. I am conducting a pilot study  on student retention strategies in engineering technology programs. This research will fulfill MA - Education degree requirements. You were selected to participate in this study because you are a dean, or senior administrator, of a school, which delivers engineering technology programs.  Participants must be 18 or older. Please confirm that you meet these criteria.

I anticipate that this interview will take about an hour to complete. There is no compensation for responding nor is there any known risk. In order to insure that all information will remain confidential I will not record your name, but list your position as Senior Administrator at College X. Participation is strictly voluntary and you may refuse to answer any question at any time.

I appreciate your assistance with this project. The data will prove useful in determining which retention strategies have been piloted for engineering technology students, and which ones are

showing to be effective. The results will be shared amongst those Deans participating, but all colleges and names will be kept confidential.

If you have any questions now or later please contact me at 416-675-6622 ext. 4131. My faculty monitor is Dr. Michael Stacy and he can be reached at 413-207-5299 or stace1mj@cmich.edu.

If you are not satisfied with the manner in which this study is being conducted, you may report any complaints to the MA in Education program, 989-774-3784.

If you are ready, we will start the interview now.

(Central Michigan University, 2013)

Confirmation for interview: Name: _____

Signature _____ Date_____