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Corporate Financial Intelligence:

Bridging the Educational Gap

An Interactive Qualifying Project submitted to the faculty of Worcester Polytechnic Institute in partial fulfillment of the requirements for the degree of Bachelor of Science by

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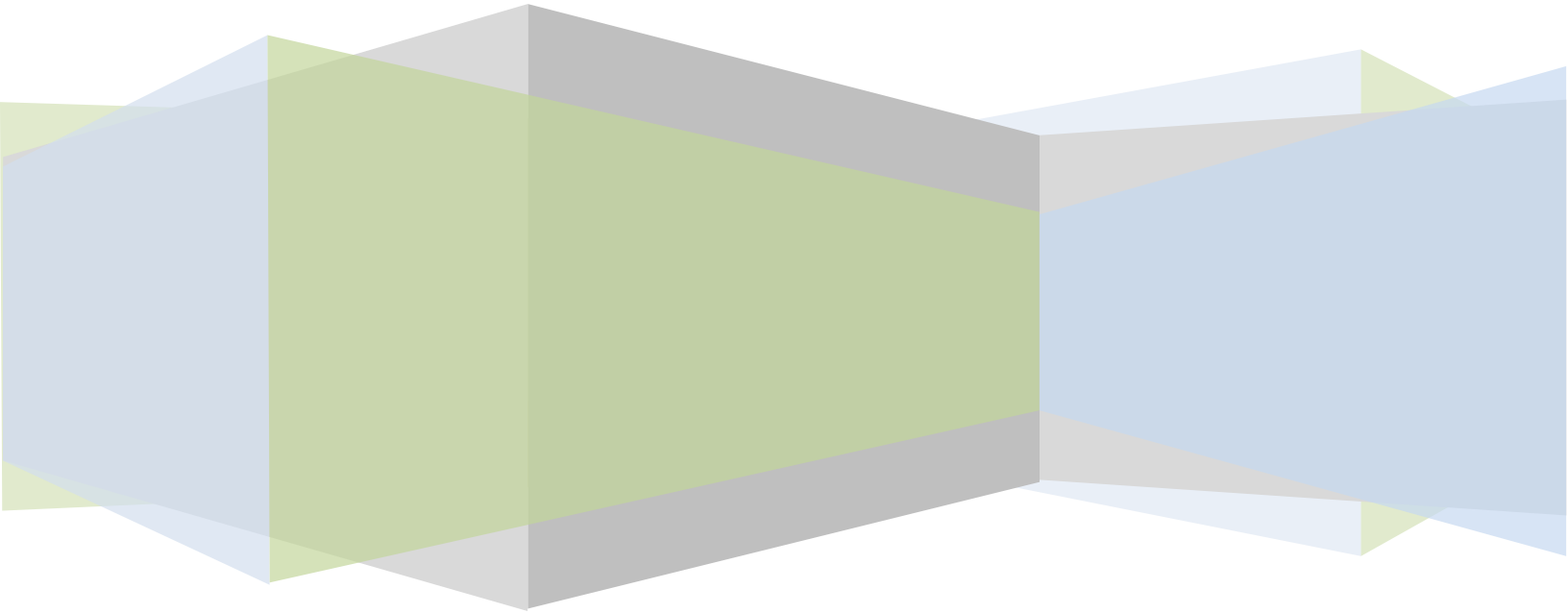

WPI

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Abstract

Entrepreneurship education can greatly benefit STEM students. STEM education is changing to realize these benefits. Through surveying students and interviewing faculty and alumni at WPI, we investigate if education properly equips STEM students with the necessary financial knowledge and skills needed in the business world. Findings show that although corporate finance is important, STEM students are generally not exposed to and lack financial knowledge. Exposure to corporate financial education through multidisciplinary projects and courses would be beneficial for STEM students.

Executive Summary

As a team of five Worcester Polytechnic Institute students, our project set out to bridge the knowledge gap between WPI students, specifically STEM (Science Technology Engineering and Mathematics) majors, and their perception of corporate financial intelligence. Although WPI produces exceptional students in technical fields, their knowledge is often limited to that of their major and students lack any education on business financials. Students can benefit from entrepreneurship education, whether or not they plan to start a business, however it is especially vital for students who intend to start business upon graduation to learn these skills in order to succeed in the world of business.

Our team evaluated this issue first through extensive research on the relationships between financial intelligence and business success rates, along with the potential for business financial education at both WPI. We found that businesses started by entrepreneurs with low levels of corporate financial knowledge are more likely to fail. This is often a result of entrepreneurs who may have exceptional concepts for a product or business plan, but do not have the skills necessary to evolve it into a successful business. STEM students are prone to this shortcoming, as their education is focused on technical concepts.

In order to prove our hypothesis, we surveyed WPI students on their levels of business financial intelligence, along with their desire to start a business and their perception of WPI's education on business financials. As expected, we found that the majority of WPI students do not have an adequate grasp on corporate finance. Despite nearly a third of WPI students reporting that they intended to start a business after graduation, only a few students indicated that they have learned any of these skills through their WPI education. In addition to our surveys, we interviewed WPI faculty and alumni to hear their perspective on WPI's role in teaching corporate finance. Without exception, each alumnus agreed that WPI did not provide them with the financial skills necessary to start their business, requiring them to rely on personal experience and outside research. Similarly, professors of both the engineering and business departments at WPI answered consistently that corporate finance education is low at WPI. They also indicated that a more involved and interdisciplinary education would highly benefit all students of the institution.

From this project, we have determined that a high level of financial knowledge is paramount to success in the business world, including students pursuing STEM majors. Consequently, a variety of programs to increase levels of corporate financial knowledge offered by the school would be extremely beneficial in preparing students for their careers.

Acknowledgements

Our project would not have been possible without the support and assistance from an amazing group of people, particularly Worcester Polytechnic Institute faculty and Alumni. We would like to thank our interviewees, alumni Todd Alexander, Joe Bush, and Dalita Tomellini, along with professors Jerome Schaufeld, Curtis Abel and Glenn Gaudette. Each took time out of their personal time to provide irreplaceable insight and perspective into our project. We would especially like to thank professors Gaudette and Abel for providing our team with the opportunity to travel to Detroit, Michigan. We would like to thank our interviewees, alumni Todd Alexander, Joe Bush, and Dalita Tomellini, along with professors Jerome Schaufeld, Curtis Abel and Glenn Gaudette. Each took time out of their personal time to provide irreplaceable insight and perspective into our project. We would especially like to thank professors Gaudette and Abel for providing our team with the opportunity to travel to Detroit, Michigan for an innovation competition which allowed us to gain firsthand knowledge and experience with entrepreneurship and business startups.

Additionally, we would like to thank WPI's librarian Laura Robinson for her assistance in developing our survey of WPI's student body.

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1.0 Introduction

Entrepreneurial education has become a growing concern among various university programs, particularly after the realization of its wide-ranging economic benefits (Kuratko, 2005). Financially, entrepreneurship raises profits, increases cash flow, and stimulates national economic growth. From social and economic perspectives, studies show that entrepreneurship improves standards of living and employment rates (Hitt, Ireland, Camp, & Sexton, 2001; Luke, Verreynne, & Kearins, 2007). Entrepreneurial education could be a viable approach to promoting the entrepreneurial mindset, thereby stimulating countries' economic growth.

Due to the various benefits of entrepreneurial education and the expansion of engineers' roles and responsibilities within work organizations, engineering students are learning about this information more than ever before (Duval-Couetil, Shartrand, & Reed, 2016). Universities have implemented entrepreneurship programs, both in and out of the engineering curriculums, to enhance the entrepreneurship skills of engineering students. These educational programs in STEM fields are in a unique position to enable students to develop entrepreneurial skills. As of now, there is a lack of clarity regarding the effectiveness of entrepreneurship education in STEM programs.

Creating and sustaining a startup requires certain skills and knowledge, including but not limited to developing a business model, understanding market needs, and managing financial resources. With only half of startups continuing to exist beyond their fifth year (U.S. Bureau of Labor Statistics, 2016), a sufficient grasp of these topics is vital to sustaining a startup, which is not emphasized in STEM programs. Therefore, we decided to focus on the financial aspects of the issues associated with startups, as they are responsible for over 50% of startup failures (Insights, 2014).

The goal of this project is to identify college students' perceptions of corporate finance and its importance at STEM institutions, particularly at WPI. We aim to to investigate and explore the role of STEM institutions in educating students about corporate finance and students' preferred learning methods. Additionally, we will explore faculty and alumni thoughts on how well STEM institutions educate and expose students to corporate finance. This investigation aids in bridging the gap between education and corporate finance, while providing an analysis of students' preferred learning methods. The surveys and interviews are a necessary part of the data collection due to the lack of studies regarding the gap of corporate finance education at STEM institutions. By collecting and analyzing the data, we can draw conclusions and make recommendations about the most effective ways to educate college STEM students about corporate finances.

The following chapter will expose background information. Later on, there will be a chapter on methodology on how to gather data. This is followed by the analysis of such data as well as our recommendations and concluding thoughts about the project.

2.0 A Background Study and Literature Review

In this chapter, we investigate entrepreneurship and its benefits, startups and their financial challenges, financial basics of business, the small business lifecycle, and finally we will conclude this section with our research questions. We wish to use this background and literature review to explore challenges related to the business world and advantages for engineers in learning about these topics.

2.1 Entrepreneurship

"Entrepreneurship" is a commonly used and widely understood term as it can be applied to all forms of businesses (Drucker, 1985; Gartner, 2007; Hart, 2003). Over the past few centuries, it has taken on various definitions in literature that ultimately describe different business processes. Dating back to the eighteenth century, the term "entrepreneurship" was used as an economic word that described the process, or activity, of taking risks by buying at certain prices and selling at uncertain prices. Later on, the term broadened to take new concepts into account, such as factors of production and innovation (Allah & Nakhaie, 2011). As a result, entrepreneurship activity has expanded allowing entrepreneurs to have more diverse roles, ranging from assuming the risk associated with uncertainty to creating a start-up of a new business (Bosma, Van Praag, & De Wit, 2000; Hébert & Link, 1989). These diverse roles of entrepreneurs have allowed scholars to explore the benefits of entrepreneurship at various levels.

2.1.1 Benefits of Entrepreneurship

As entrepreneurs assumed more roles, scholars gave more attention to the effect of entrepreneurship in national economic development. Audretsch, Grilo, & Thurik (2011), Luke, Verreynne, & Kearins (2007), and Wennekers & Thurik (1999) show that entrepreneurship is crucial for the economic growth. In addition to the economic benefits, entrepreneurship has non-financial benefits, such as improving standards of living and employment rates (Hitt, Ireland, Camp, & Sexton, 2001; Luke, Verreynne, & Kearins, 2007) . However due to the expansion of entrepreneurship activities, there is consensus that measuring both its non-financial and financial benefits should be done at various levels (e.g. at the individual, organizational, and national level) (Luke et al., 2007). This approach is important because entrepreneurship benefits vary at different levels. In the following sections, we analyze these benefits at multiple levels: the individual level, the organizational level, and the macro level.

At the individual level, scholars direct their analysis towards individuals who assume activities characterized by innovation, risk, and growth. Autonomy, the need for achievement, job security, and the opportunity to experiment resulting in positive learning outcome are some of the non-financial benefits that drive entrepreneurial activity of individuals (McClelland, 1961; Mintzberg, 1973). While these benefits motivate some entrepreneurial activities, it is assumed that financial benefits are the main driving objectives for many of those activities (Kirzner, 1979;

Zahra, Sapienza, & Davidsson, 2006). Therefore, financial benefits, such as financial security and rewards through increasing profits, are important objectives for individual entrepreneurs.

At the organizational level, entrepreneurship is concerned with the organization as a whole. Similar to entrepreneurship at the individual level, there are non-financial benefits at the organizational level, such as market leadership and increased levels of innovation (Porter, 1980). However, there is a noticeable focus on the financial benefits at the organizational level that lead to wealth creation and improved financial performance (Hitt, Ireland, Camp, & Sexton, 2001). Murphy, Trailer, and Hill (1996) identify these benefits through the growth in revenue and profits of the organization over time. Additionally, organization's financial objectives also include increasing its market share as well as increasing its levels of productivity (Haber & Reichel, 2005).

At the macro level, similar to both the individual and organizational levels, entrepreneurship has both non-financial and financial benefits . This macro level analysis ranges from analyzing the entrepreneurial benefits of various industries to various countries (Davidsson & Wiklund, 2001). The non-financial benefits vary widely, ranging from creation of new markets (Schumpeter, 1934) to increased standards of living and creation of value through employment (J. Ward & Aronoff, 1993). On the other hand, financial benefits include economic growth, such as the growth of gross domestic product (GDP) of countries (Luke et al., 2007). Additional positive impacts of entrepreneurship result from the rise of the entrepreneurship rate (number of business owners per labor force) of twenty three member countries of the Organization for Economic Cooperation and Development (OECD); this rise of entrepreneurship rate is associated with lowering the rate of unemployment from 1984 to 1994 (Audretsch & Thurik, 2001). In addition to lowering the rate of unemployment, economic growth benefits from new business formation.

Studies of new and small businesses, or startups, are a key foundation of entrepreneurship literature (Cameron & Massey, 2002; Covin & Slevin, 1989; Glancey, McQuaid, & Campling, 2000). Moreover, entrepreneurship thrives through the creation of these startups and strengthens the economy. Economic growth depends more on the rate of new business formation than on the rate of existing business expansion (Malecki, 1988; Wennekers & Thurik, 1999). As Lazear (1995) pointed out, the economies of the Eastern European countries that grew the fastest were those with the most rapid new business formation.

Of course, the formation of new businesses comes with many challenges. In the next section, we will explore the main financial challenges that startups encounter.

2.1.2 Financial Challenges of Startups

While startups contribute immensely to the economic growth, they are more prone to failing than established businesses due to financial challenges. These challenges are detrimental to new businesses as they generally do not have the means (cash flow), which established

businesses may have from other operations to potentially offset or accommodate initial losses from entrepreneurial ventures. As a result, not all startups survive and grow to become successful or are acquired by large businesses. Additionally, startups may encounter challenges that prevent them from growing or the general nature of their businesses (Scott & Bruce, 1987). Based on the analysis of over a hundred startups post-mortems, financial challenges are responsible for more than 50% of startup failures (29% running out of cash, 18% pricing and cost issues, and 8% no investor interest), as illustrated in Figure 1.

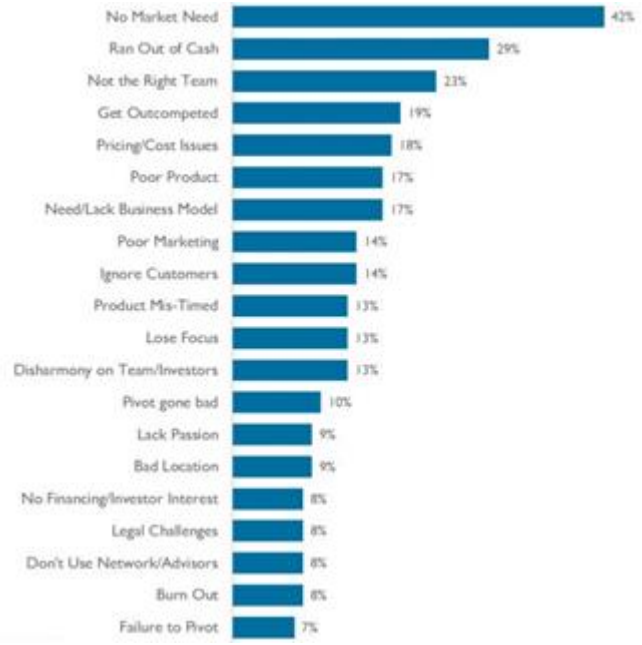

Figure 1: Top 20 Reasons startups fail according to analysis of 101 startups post-mortem (Insights, 2014)

Therefore, financial knowledge is crucial to startups' growth. In order to maintain cash flow for day-to-day operations, entrepreneurs should plan ahead to meet funding requirements and ensure that the business can be sustained.

2.2 Business Financial Basics

The first step in establishing a sound financial basis for a new business is to consistently compile a complete and accurate set of financial statements. This allows the company to properly assess and analyze its finances, including but not limited to assets, liabilities, and equity of the company. Balance sheets, income statements and cash flow statements are the three fundamental documents for businesses to keep track of their finances and plan (See Appendix).

The income statement and balance sheet are very closely connected, as the income statement is used to determine how profitable an enterprise is by recording the revenues along with expenses over a period of time. This allows the business owner to determine whether the company earned a profit over the given period of time (Vacher, 2014). The balance sheet is a recording of a company's financial status at a given time and includes assets, liabilities, and equity. The income statement and balance sheet are linked by profit and equity, with transactions

recorded on an income statement being associated to the balance sheet (Vacher, 2014). The balance sheet can be used to determine a company's net worth as well as the owner's equity in the company.

Cash flow statements are also a crucial piece of the financial documentation for a business. The cash flow statement acts as a flowmeter for money coming in and out of the company. The target cash flow is a key measure of business performance as compared to profit, which gives a direct insight to a company's success and shows where the company's money is going (Vacher, 2014). As a reality check for the business, cash flow statements are often used to demonstrate to investors how the company is currently spending their money to prove that they can be trusted with future investments (Vacher, 2014). As a result, these documents should be understood, prepared, and properly analyzed in order for the business to succeed.

Along with appropriate understanding of financial statements, new small business owners also need to consider the effects of private equity and debt markets in respect to a business's financial growth cycle. The principle owner contributes the largest share of his/her company's total capital in the early stages. However, entrepreneurs starting a business typically do not have sufficient capital to completely fund the business themselves (Wetzel, 1994). As a result, business owners must find outside sources to supplement the finances of their business.

Angel investors and venture capitalists are two of the main sources for funding startups. Angel investors can provide capital at the early stage of a startup; however, Becker (2010) notes that they are more interested in those startups that have the ability to impact large markets than those with a smaller potential for market impact. Additionally, venture capitalists are more likely to invest in a startup that has raised the initial capital (seed capital) and has achieved steady growth (Yetisen et al., 2015). Venture capitalists and angel investors are ideal sources for a small business because they result in less debt within the small business, thus maximizing total worth; however, they take business equity in return (Berger & Udell, 1998).

Debt from outside sources, such as bank and government loans, credit cards and individuals, accounts for 50.38% of small business funding. Although debt is usually a common, effective, and necessary strategy for entrepreneurs to obtain working capital in small businesses, it should be managed based on income potential. The higher the risk of not converting capital created from debt into income, the higher the risk of failure. Debt is more often utilized by established small businesses due to the higher income potential and should only be used by newer small businesses as a last resort to prevent negative impacts on the business owner's and lenders' finances should the business fail (Fluck, Holtz-Eakin, & Rosen, 1998; Saretto & Tookes, 2013; Giroud & Mueller, 2015).

2.3 Small Business Lifecycle

Entrepreneurs often encounter difficulties if they do not appropriately prepare for the challenges of undergoing the business lifecycle. Oftentimes, it is the unfamiliarity with the

business lifecycle and the entrepreneurs' lack of experience that makes them ill prepared for these challenges (Vohora, Wright, & Lockett, 2004). In fact, there are crises that occur throughout the evolution of a business. As such, having awareness of future obstacles increases the likelihood of a startup's success (Scott & Bruce, 1987). In order to expose the strategies of developing a startup company, we underline the various obstacles and potential solutions to these issues of the small business lifecycle.

2.3.1 Challenges of the Small Business Lifecycle

The business lifecycle comes with an assortment of daunting challenges for new entrepreneurs. Through the stages of a company's creation and initial survival, a strong financial foundation is necessary as a lack of a financial backing is a certain cause for failure. In particular, without producing adequate services, entrepreneurs will have difficult time moving resources and capital (Chang, 2015). As the company progresses, the entrepreneur will encounter new issues in regards to growth and expansion. These problems include achieving sustainable returns and becoming profitable (Vohora et al., 2004). Investors will not simply hand over money without reasonable proof of the business's future success (Chang, 2015). Thus, entrepreneurs will find it challenging to move forward with their companies without overcoming these issues associated with the small business lifecycle.

2.3.2 Combating the Challenges of the Small Business Lifecycle

With these challenges come the formulated solutions to combat these problems. In order to solidify a concrete foundation for financial backing, creating a sustainable financial foundation is critical to ensure a company's success. Entrepreneurs should be producing products and services that satisfy customers so that they are able to generate a decent return to their investors (Chang, 2015). In regards to growth and expansion of the company, investors will prove to be vital. However, it is the awareness that these investors have their own criteria for evaluating whether they should invest in certain businesses that will help with enticing them to fund one's company. For example, Marc Andreessen, a successful VC, has three investing criteria (Chang, 2015):

1. An enormous market for whatever they business is trying to sell

2. A fundamental technological or economic change

3. A strong founding team

Investors attempt to ensure a return on their investments by looking for similar criteria as listed above. Oftentimes it is necessary to find creative ways to attract investors to see the merit of the business and the promise of return on their investment soon, ensuring that investors will not be wasting money and resources on a dying project (Chang, 2015). In addition to investors, growth and expansion of the company are highly motivated by seizing opportunities and increased budgetary control. Within a given economic environment, there may be certain

economic opportunities and advantages. Entrepreneurs who are able to identify and strategically utilize these advantages are the ones that have the greater chance of expanding their companies (E. A. Ward, 1993).

In conclusion, entrepreneurs who have the necessary financial skills are able to advance through the challenges encountered at various stages of their business development. It is important to note that, although STEM majors have some advantageous tools to carry out entrepreneurial tasks, it is unclear whether they possess the financial knowledge necessary to start a business. In the following section, we will discuss some of the advantages engineers have in the business world.

2.4 Engineering Advantages

Engineers possess qualities that make them ideal for both management and entrepreneurial tasks. They are detail oriented, highly analytical thinkers, and experienced problem solvers (Al-Saleh, 2014). Evidence of this is that 23% of the 2007 list of Fortune 500 CEOs have undergraduate degrees in engineering, which is double the amount that majored in economics or business (Sternberg, 2007). Additionally, in 2011, this percentage of engineer CEOs increased to 33%. Other groups have picked up on this trend as well; the Department of Defense and the National Science Foundation developed the Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) program in order to support the development of small businesses in technology related fields. Moreover, Kern Entrepreneurship Education Network (KEEN) foundation supports promoting an entrepreneurial mindset of engineering students through entrepreneurial education, as they believe that engineers provide valuable input towards the cultivation of STEM related markets.

2.4.1 STEM Fields' Market

Over the last fifteen years, the global GDP has grown at an average of about 2.5%; however, STEM fields markets have grown at a rate of almost double that of the average. Additionally, between 2004 and 2012, STEM fields' market grew at a rate of 4.2%, even with the recession (Oak, 2014). A 2008 Kauffman Foundation report states that nearly 50% of U.S. startup founders hold STEM degrees (Hixson, Paretti, & Lesko, 2012). Currently the field is predicted to grow at a rate of upwards of 5% in the next few years (Bartels, 2016). The current and future field of technology and science is therefore one of the most ideal fields for small businesses to form and grow.

2.4.2 Patents and Intellectual Property

The growing global technology business environment thrives on innovation that engineers can provide through product design concepts and patents (Bartels, 2016). A large advantage that technological companies possess over counterpart non-technical companies is the access to patents. These patents can protect their ideas that comprise the core of their product line or business model. Patents allow small businesses to protect their intellectual property in a limited corner of the market, while still ensuring that they are safer from larger corporations and

other rivals modifying their designs (Sheafe, 2016). For example, Dropbox co-founders were able to isolate a section of the market and patent a network folder synchronization program in order to share files to cross-platform users, which resulted in the program becoming immensely popular and constructed the basis of their entire business (Mayer, 2015).

In order to utilize these tools, engineers need the financial knowledge and skills necessary to overcome entrepreneurial difficulties. Entrepreneurship education can improve these skills and should be included in curricula at the university level (Besterfield-Sacre, Zappe, Shartrand, & Hochstedt, 2016; Zappe, Hochstedt, Kisenwether, & Shartrand, 2013).

2.5 Entrepreneurship in Engineering Education

Originally, entrepreneurship courses originated in business or management schools, but over the last two decades these courses spread to most academic disciplines (Streeter & Jaquette Jr, 2004). This change emerged after realizing that entrepreneurship education can greatly benefit all students. Additionally, several foundations have pushed for this change, particularly over the last decade. The Kauffman Foundation provides funding for universities to support cross-campus entrepreneurship education and awareness (www.kauffman.org). The Coleman Foundation provides entrepreneurship training and resources to faculty in multidisciplinary programs (www.colemanfoundation.org). The Kern Family Foundation, through the Kern Engineering Education Network (KEEN), provides funding and resources to engineering schools to instill the entrepreneurial mindset into engineering programs (Kriewall & Mekemson, 2010).

Despite all the efforts to educate and increase the exposure of engineering students to entrepreneurship, there is a lack of clarity on how effective these programs are in achieving their goal. A survey report of 144 engineering faculty from 90 institutions (Peterfreund, 2013) indicated that the incorporation of entrepreneurship in engineering programs are not widely practiced. Moreover, a study of 341 American Society for Engineering Education (ASEE) member schools found that the delivery of entrepreneurship education to undergraduate engineers was not yet widespread or institutionalized (Duval-Couetil, Shartrand, & Reed, 2016). Rather single individuals, instead of college or university administrators, promoted institutional acceptance of incorporating entrepreneurship in STEM programs. In their study Standish-Kuon and Rice (2002) suggested that a major obstacle in the way of delivering entrepreneurship education to STEM students is the lack of available space for electives or extracurricular activities.

In this project, our goal is to investigate and evaluate if STEM institutions equip engineers with the necessary financial knowledge needed in the corporate world. We will achieve this by answering the following research questions.

2.6 Research Questions

Entrepreneurship thrives through the generation of new small businesses and the lack of financial knowledge is associated with more than 50% of new business failures (Insights, 2014).

With the data collect from our survey, our first research question we plan to address is, **what is STEM students' perception of how much they know about corporate finance?**

Hypothesis 1: We predict STEM students will report having minimal knowledge about corporate finance related material.

Our second research question is, **what are STEM students' beliefs about the importance of corporate finance regardless of one's field of interest?**

Hypothesis 2: We predict that they believe that corporate finance is important regardless of one's field of interest.

STEM students are being exposed to entrepreneurial education more than ever before, especially after this education was linked to an increase in entrepreneurial intentions and behavior, such as creation of new business ventures (Rauch & Hulsink, 2015). Therefore, our third research question aims to find out **what role do STEM institutions play in educating their students about corporate finance?**

Hypothesis 3: We predict that institutions have the tools to educate students about corporate finance; however, they do not reach a large portion of the student body.

Finally, we want to see that students' perspective on their preferred delivery methods of corporate finance education. We will be answering **how do STEM students want to obtain their knowledge about corporate finance?**

Hypothesis 4: We predict that students would want it to be integrated into major-specific courses due to the lack of free space in their course schedule to take electives.

3.0 Methodology

We investigated several methods to analyze and assess the corporate finance knowledge and interest of STEM students. We looked at the pros, cons, validity, and reliability of each. An instrument is reliable if it produces the same result when the same property is repeatedly measured. On the other hand, an instrument is valid if it measures what it is supposed to measure (University of Wisconsin, 2010). The methods we investigated are: surveys, interviews, observations, previous literature analysis, experiments, focus groups and observations among others. The following table shows the pros, cons, validity, and reliability of each method mentioned above:

Table 1: Methods Pros and Cons (adapted from Berg & Lune, 2012; Libarkin & Kurdziel, 2002; Mann, 2003; Schram, 2014; Theory, 2014)

Type	Method		Validity/Reliability	
	Pros	**Cons**	**Pros**	**Cons**
Survey	Collects relevant data in a non-threatening way	Does not show the full story	Established statistically	Establishing validity is time consuming and response bias can exist
Interview	Allows for greater depth and is not expensive	Accesses a smaller sample. Potentially time consuming	Established by connection to the source or interviewee	Can be bias as the interview questions are shaped by the interviewer.
Previous literature analysis	Provides rich detail and unconstrained approach of data collection	Is not randomly selected. Could only be applicable to small range of settings	Established through logical flow and no statistics are required	Can be bias as individualistic believes might shape the drawn conclusions of the research.
Experiment	States the cause and effect explicitly	Can be very time and resource consuming	Established through cause and effect	Needs testing of multiple groups in multiple markets.
Focus Groups	Can be an effective way of getting in-depth information	Needs a good facilitator to manage the discussion	Established through common impressions	Can be hard to analyze responses
Observations	No need to schedule events as they occur	Can be difficult to interpret observations	Established through replication	Can be difficult to categorize/interpret observations

To examine the research questions mentioned in section 2.6, we are mainly using two different methods, which include administering surveys and conducting interviews. We have chosen these methods carefully so that we can acquire the most useful data needed to answer our

research questions. We have decided that the use of a survey questionnaire will be the most appropriate instrument to acquire quantitative data about STEM students as it would reach a larger sample while being less time-consuming than interviewing or observation. To acquire insight about difficulties from various alumni entrepreneurs, the team has decided that conducting interviews is the most appropriate method as it gives more in-depth details about the issues and difficulties than those details acquired by other methods. The reasons behind not choosing other methods are detailed below.

Due to the nature and time constraint of our project, we have decided that case studies would not be a good method of collecting data as it is time consuming and would neither generalize nor provide the team with the desired outcomes. Also, we have decided that the data collected by previous literature analysis, in addition to being time-consuming, would be limiting and incomplete; therefore it would not be sufficient to support our objective. We have also looked in-depth at organizing focus groups. We decided that our efforts would be better spent pursuing other methods of research rather than attempting to gather four to six experienced faculty members or students to at the same time for conducting a focus group, even though it is a very informative method. Therefore, the team has decided to focus on the usage of surveys and interviews in the data collection process.

3.1 Surveys

Surveys are a data collection method that is used to describe, compare, or explain individual and societal knowledge, feelings, values, preferences and behavior (Fink, 2012). Surveys are administered by asking questions to individuals and then analyzing the results to generalize to the groups represented by the respondents. According to McNamara (2006), a survey's purpose is to acquire much information from a large population without being time consuming.

3.1.1 Survey Purpose, Population and Sampling

Since the first and most crucial step in designing a survey is to determine the purpose of the survey by defining the questions to be answered by the survey results (MIT, 2015), the survey questionnaire needs to be carefully developed and structured so that it allows us to attain useful data to our analysis while maximizing the response number of the targeted sample. Along with determining the purpose of the survey comes determining the targeted population, which is the sum of all persons or things that are to be studied in a research (Bailey, 1982). When the population is small, it is becomes more feasible to survey the entire population; however, often that is not the case (University of Wisconsin, 2010). As a result, sampling is used to survey only a subset of the entire population of interest, given that 30 is the least number of participants in a sample to give an adequate approximation of normality due to Central Limit Theorem (Petruccelli, Nandram, & Chen, 1999). In our project, we have decided to use WPI's student body as a sample for STEM students, since WPI is an institution centered on STEM programs.

3.1.2 Formulating the Questionnaire and Challenges

In order to attain useful and meaningful results, one has to structure the survey questionnaire so that it maintains its reliability and validity. A questionnaire is reliable if it produces the same result when the same property is repeatedly measured. On the other hand, a questionnaire is valid if the questions measure what they are supposed to measure (University of Wisconsin, 2010). Therefore, an ideal survey questionnaire would contain questions that mean the same to the sample or entire population. Because the process that goes on in a person's mind after they have been asked a question and they answer is different from one person to another, bias is introduced and it can affect the reliability of the survey (Bechhofer & Paterson, 2012).

Additionally, it is crucial to use common language in the questionnaire to minimize the bias in surveys. We need to avoid using fragments or slang as they are not appropriate to use in a professional setting. Similarly, avoiding technical expressions can help in eliminating bias as these expressions can be confusing and not understood by everyone; however, it would be rather difficult to avoid using these expressions since finance is quite technical. It is also important to define questions very specifically to avoid imprecision; for example, there is a critical difference in precision between asking "How important are you values?" and "How important are you religious values?" the second being more precise. Additionally, avoiding complex sentences with too many clauses and using double negatives reduces potential respondents' errors (Harvard, 2007; University of Wisconsin, 2010).

In formulating the survey questions, the team can use closed and/or open-ended questions to gather the needed information. When well designed, closed-ended questions ensure that the respondents interpret questions the same way. Often, they provide information, which, unlike open-ended questions, does not require interpretation. Having a survey with more closed-ended questions than open-ended questions can increase the response rate since respondents are more likely to skip an open-ended question (Harvard, 2007). For closed questions, answer choices should include all possibilities; therefore, it is good to include "If other, specify" category. In the case of using Likert scale, which is a rating scale, including N/A improves the survey design. For attitude questions and questions that measure feeling, it is better to use five or seven point scale Likert scale, which a rating scale that provides a middle category, for best results (Harvard, 2007; University of Wisconsin, 2010). Also, including demographic questions, such as gender, age, graduation year and citizenship will aid in drawing conclusions regarding the population (See Appendix B).

Before administering our survey, we completed the WPI Institutional Review Board (IRB) forms, which allow WPI to recognize our survey and make sure that the survey participants' rights are protected (See Appendix F).

3.1.3 Administrating Surveys

Options for administrating a survey include mail surveys, group surveys, and phone surveys. Due to this project's time constraint and the cost associated with administrating the

different types of surveys, the team has decided to utilize the electronic survey. Conducting electronic surveys has many advantages, such as removing interaction bias between the researcher and respondent since there is no direct contact between them. Also electronic surveys tend to have higher response rate than mail or phone interviews (Dillman, 2000). We have investigated the WPI Gordon Library resources and found that WPI recommends a survey engine called Qualtrics. Qualtrics is free of cost for WPI students and it has the features that we are looking for, such as skip logic and carry forward questions. We e-mailed the survey questionnaire to different on-campus clubs and organizations and posted the survey on WPI's class-groups Facebook pages. Additionally, we table sat in the Rubin Campus Center, a popular destination for many students, with computers so that students can voluntarily take our survey. This allowed us to collect an adequate sample of quantitative data; however we conducted interviews to get in-depth, detailed data for our project.

3.2 Interviews

Conducting an interview is a tailorable, more personalized method of data collection which allows interviewing to be more of a specific supplementary source rather than a provider of all-encompassing data. Interviews allow for greater depth and clarification on certain topics, especially if the information is coming from a rather knowledgeable person on the topic (Driscoll & Brizee, 2010). Therefore, it is rather important to prepare for interviews.

3.2.1 Enlisting Interview Participation

We start preparing for interviews by searching for the proper respondents. We choose to find those that have experience with entrepreneurship combined with STEM backgrounds, such as WPI faculty that are involved in entrepreneurship and current entrepreneurs with STEM backgrounds. Since we live in a society highly reliant on electronic interaction, email is certainly one of the most effective ways to reach participants. Therefore, by targeting the most appropriate interviewees through emails, we can make use of interviews in our research process.

3.2.2 Interview Preparation

Not only do we have to enlist the cooperation of interviewees, but also we must prepare ahead of time what we will be doing in there interview. First, we should consider the meaning of the information that we attempt to assemble from each question (Berg & Lune, 2012). We center our questions on what the respondents found in regards to success, failure, approach, and other subjects related to startups. It is also crucial that the advisor reviews the formulated questions to be sure that the questions are appropriate and capture what we are looking for. Furthermore, we rehearse in order to become familiar with all the interview's aspects, reviewing the knowledge of our research so that we can explain it to the respondents. These acts in regards to the success and importance of the interview increase the likelihood of inspiring the respondent to be upfront about everything.

Additionally, the WPI IRB requires us to send a set of sample interview questions to them before conducting the interviews. This assures that our questions comply with ethical research guidelines.

3.2.3 During the Interview

There should be two or three people that administer the interview. This is so that we do not intimidate the respondents with too many people and avoid the issue of having too few interviewers. With the permission of the respondents, we record the interviews to have a record that we may reference in the future. If they do not consent to recording the interview, it is important for at least one of the interviewers to jot down notes. Even if what the respondent is saying does not seem to have any importance at the time, we should record it because it might be important in the future.

During the interview, we must prepare to motivate respondents to say as much as they can in regards to the topic, clarify any confusion or concerns, and observe quality of responses. It is important that we are presentable and invite the respondent by explaining the study or research in a clear and concise manner. After that, it is important to use the predetermined questions because, if modified during the interview, we might change the entire meaning of the question (Trochim, 2006). We can observe respondents as we ask questions, including their nonverbal behavior and reaction time, while still maintaining the structure of the original questions (Bailey, 1982). However, deviation is acceptable if it is in addition to the established plan. For instance, being able to adapt to the respondent's various answers as they go will oftentimes lead to a better interview (Berg & Lune, 2012, p. 108). It is important that we consider everything the respondent has to say as important information relevant to your topic; therefore, recording responses without any sort of interruption is vital. If necessary, we may probe for information from the respondent through encouragement and asking for clarification or elaboration. At the end of the interview, the interviewer should thank the respondent without being too hasty and record any thoughts about the interview (Trochim, 2006).

3.2.5 Challenges and Solutions of Interviewing

Interviews elicit challenges both before and during the interview that require attention. Because we intend to find and encourage respondents to cooperate, interviews tend to be one of the slowest techniques of data collection (Trochim, 2006). During the interview, having strong people skills is useful in order to maintain a useful discussion and produce information worthy of analysis. In fact, it is often necessary to use those social skills to start the interview with some small talk in order to get the interview going (Driscoll & Brizee, 2010). This personalized conversation will help to overcome preconceived notions of the respondent(s) that could hinder the meaning and even the success of the overall interview process (Berg & Lune, 2012). It is also important to not pester or push the respondent; instead, we should allow the respondent to talk about other things that relate without going off-topic (Driscoll & Brizee, 2010). Interviews generally result in qualitative data and questions should not be biased, confusing, wordy, or

unrelated (Driscoll & Brizee, 2010). As a result, it is necessary to think of these challenges when utilizing interviews for a method of research so that the interviewer may avoid them.

In the following chapter, we analyze both our quantitative and qualitative data to draw conclusions and provide recommendations.

4.0 Data Analysis

In order to fully understand the survey and interview results and answer our research questions, we will proceed through three main steps of analysis. The first step is to do quantitative data analysis of the survey, which is the process of analyzing numbers to interpret data using different statistical methods (Cook, Kress, & Seiford, 1996). Secondly, we will analyze our conducted interviews, which will allow us to abstract some sort of understanding of the people we are interviewing from the qualitative data collected (Gibbs, 2002). Finally, given that qualitative analysis provides detail lacking in a quantitative research and quantitative analysis expands the implications of a qualitative study, we will link quantitative and qualitative data analysis to obtain a better understanding of our research and strengthen our findings (Libarkin & Kurdziel, 2002).

4.1 Quantitative Data Analysis

In this section, we use both descriptive and inferential statistics to analyze the results and draw conclusions. The descriptive statistics, such as mode, median, mean, or range, summarize our data in a meaningful way, for example, by showing patterns. On the other hand, inferential statistics, such as correlation, t-tests, or analysis of variance (ANOVA), allow us to draw conclusions, make generalizations about the sampled population, and help us make suggestions, as well as reinforcing the patterns we see (Lund Research Ltd, 2013). In the following subsection, we outline the techniques we used to answer our research questions. Then, we will check whether our sample of the WPI student body is representative of the current WPI population. Finally, we will discuss the results of our research questions and do additional analysis to better understand our results.

4.1.1 Variable Description and Statistical Tests Used to Answer Research Questions

To answer **research question one**, which asks about STEM **students' perception of their corporate finance knowledge,** we will examine student responses to question 6 (See Appendix B). We asked students to rate their level of knowledge about six different corporate finance-topics: financial documents, bonds, time value of money, corporate taxes, venture capital, and angel investors. This was reported by having students rate their own knowledge on a five-point response scale (not knowledgeable to extremely knowledgeable) that we can use to obtain the mean of students' self-reported knowledge of the six topics mentioned previously.

As for our **second research question**, which pertains to **students' beliefs about the importance of corporate finance**, we will examine the responses to question 5_a (See

Appendix B). This question asks about the level of agreement to the following statement: Corporate finance is an important skill to have regardless of one's field of interest. The question used a one to five scale (one meaning strongly disagree and five meaning strongly agree). Answering this question will depend on sample distribution statistics, such as mean and mode.

To answer **research question three**, which asks about **the role STEM institutions play in education their students about corporate finance**, we will look at different factors. First, similar to the techniques we will use in answering research question two, we will analyze the responses of question 5_b (See Appendix B), which measures the level of agreement to: I have been well educated and exposed to corporate finance at WPI. Then, we will look at the student percentages who have been involved in any on-campus entrepreneurship activities, such as clubs, or those who have taken any courses related to corporate finance. Additional analysis will include conducting a one-way ANOVA on the six different corporate finance-topics to determine if differences existed among students who have been involved in on-campus entrepreneurship activities, have taken courses related to corporate finance, and those who have not been exposed to corporate finance at WPI.

Finally, to answer the **fourth research question**, which asks about **students' preferred method of learning about corporate finance,** we will analyze the student responses to question 8. In the our survey, question 8 (See Appendix B) is a multiple choice question with five choice-options (the fifth option being "other" with an option of text-input, in case none of the four previous choices apply to the student). Outputting the response percentages of each of the five choices will answer our final research question by showing what the general consensus is about the preferred method of learning about corporate finance.

However, before advancing into answering our research questions, we will check the representativeness of our sample by comparing it to the WPI student-population to ensure there are no major differences.

4.1.2 Survey Participants

To distribute the survey, we posted a link on the WPI class Facebook page of each year. We also table sat in the Rubin Campus Center with computers so that students could voluntarily take our survey. In total, 430 students started answering the survey, but only 390 answered the full survey. These 40, who did not finish the survey, left substantial number of questions blank and as a result were removed from our data analysis. Additionally, out of the 390 responses, only 13 (3.3%) were from graduate students, compared to the (32.3%) of the WPI student-population being graduate students. As a result, we have decided to remove those 13 responses from our data analysis. Table 1 provides an overview of the survey-sample demographics compared to the 2016 WPI student-body demographics.

Table 2: Student Survey Demographics

Demographic	Survey Participants		WPI 2016-Demographics	
Class-Year	**Number (N)**	**Percentage**	**Number**	**Percentage**
Freshman	84	22.3%	1064	25.2%
Sophomore	117	31.0%	1008	23.9%
Junior	100	26.5%	900	21.4%
Senior	76	20.2%	1242	29.5%
Gender				
Male	189	50.1%	2776	65.9%
Female	182	48.3%	1438	34.1%
Prefer not to answer	6	1.6%	-------	-------
Major				
STEM student	372	98.7%	3834	91%
Non-STEM student	5	1.3%	380	9%
Total	377	100%	4214	100%

The sample adequately represents the WPI population with two exceptions. The first is having more responses from sophomores and fewer responses from seniors than expected by the actual WPI demographics. The second exception is having almost equal response-rate from females as from males, although females only represent about one-third of the WPI undergraduate student population. This exception was expected since females are more likely to participate in surveys than males (Curtin, Presser, & Singer, 2000; Singer, Van Hoewyk, & Maher, 2000). Additionally, it is important to note that over 98% (N=372) of undergraduate students who answered the survey are pursuing a STEM degree, which is higher than that of the WPI population. Please refer to Appendix for full demographic table of students surveyed divided by major. Now that we have looked at the demographics of the students surveyed, we can analyze the results to answer our research questions.

4.1.3 Results by Research Question

What are STEM students' perception of how much they know about corporate finance?

Hypothesis 1: We predict STEM students will report having minimal knowledge about corporate finance related material.

We examined participants' self-reported knowledge about six topics (i.e. Financial Documents, Bonds, Time value of money, Corporate Taxes, Venture Capital, and Angel Investors). The mean responses for the above topics are provided in Table 3 with a scale of one to five (one being not at all knowledgeable, five being extremely knowledgeable):

Table 3: Mean Values of Student Self-Reported Knowledge

Topic	Financial Documents	Bonds	Time Value of Money	Corporate Taxes	Venture Capital	Angel Investors
Mean Values	2.39(1.02)	1.89(0.991)	2.60(1.128)	1.66(0.885)	1.60(0.923)	1.49(0.885)

These results support our initial hypothesis that, in general, students' knowledge on topics related to corporate finance is minimal. Further (untabulated) analysis of the acquired data leads to more interesting findings and conclusions. Each financial knowledge topic had a strong, positive correlation with each of the others, so an individual who answered strongly for any topic was likely to answer strongly for other topics as well. As shown in table 4, an ANOVA test shows that the self-reported knowledge with topics related to corporate finance has no significant mean difference across class years (Freshman N=84, Sophomore N=117, Junior N=100, Senior N=76). All sig. values (p-values), highlighted below, are > 0.05, suggesting that students are not gaining knowledge of these topics while at WPI.

Table 4: ANOVA of Self-Reported Knowledge Level by Class

ANOVA of Self-Reported Knowledge Level By Class

		Sum of Squares	df	Mean Square	F	Sig.
Financial Documents (i.e., income statements, balance sheets, etc.)	Between Groups	3.761	3	1.254	1.219	.303
	Within Groups	383.697	373	1.029		
	Total	387.459	376			
Bonds	Between Groups	.074	3	.025	.025	.995
	Within Groups	369.247	373	.990		
	Total	369.321	376			
Time value of money (present vs future)	Between Groups	.484	3	.161	.126	.945
	Within Groups	478.232	373	1.282		
	Total	478.716	376			
Corporate Taxes	Between Groups	1.535	3	.512	.652	.582
	Within Groups	292.683	373	.785		
	Total	294.218	376			
Venture Capital	Between Groups	3.018	3	1.006	1.183	.316
	Within Groups	317.094	373	.850		
	Total	320.111	376			
Angel Investors	Between Groups	3.608	3	1.203	1.544	.203
	Within Groups	290.589	373	.779		
	Total	294.196	376			

As shown in table 5, t-test between those who have taken corporate finance related classes (Case 1, N=46) and those who have not (Case 2, N=331), show that the former report

higher knowledge, with exception of the knowledge of Corporate Taxes. A similar result is found in a t-test involving those who have joined a club or society involving entrepreneurship or business (Case 3, N=28), showing a higher self-reported knowledge on the subjects of Bonds, Venture Capital, and Angel Investors than those who are not (Case 4, N=349).

Table 5: Means of Self-Reported Knowledge in Four Cases

Topic	Financial Documents	Bonds	Corporate Taxes	Time Value of Money	Venture Capital	Angel Investors
Case 1	3.09 (1.007)	2.24(0.947)	1.85(0.956)	3.17(1.081)	2.13(1.166)	1.91(1.189)
Case 2	2.29(0.045)	1.84(0.989)	1.64(0.871)	2.52(1.113)	1.53(0.861)	1.43(0.819)
T, P values	-5.156, 0.000	-2.579, 0.010	-1.514, 0.131	-3.766, 0.000	-3.357, 0.001	-2.674, 0.010
Case 3	2.39 (0.916)	2.43(1.289)	1.61(1.031)	2.79(1.166)	2.14(1.113)	2.07(1.245)
Case 4	2.39(1.024)	1.85(0.952)	1.67(0.873)	2.58(1.126)	1.56(0.894)	1.44(0.834)
T, P values	0.03, 0.976	2.344, 0.026	-0.348, 0.728	0.921, 0.358	3.248, 0.001	2.631, 0.013

What are STEM students' beliefs about the importance of corporate finance regardless of one's field of interest?

Hypothesis 2: We predict that students believe that corporate finance is essential regardless of one's field of interest.

After analyzing the student responses on question 5_a, as seen in Figure 2, students' perception of the importance of corporate finance is high (mean = 3.96, on a scale of 1 to 5 with SD = 0.954). Results (untabulated) from an ANOVA test show that there is no significant difference in the perceived importance across class-years. Additionally a t-test (t = 1.654, p = 0.099) showedno significant difference in response to question 5_a between genders. These results show that there is a general consensus about the importance of corporate finance, providing support for Hypothesis 2.

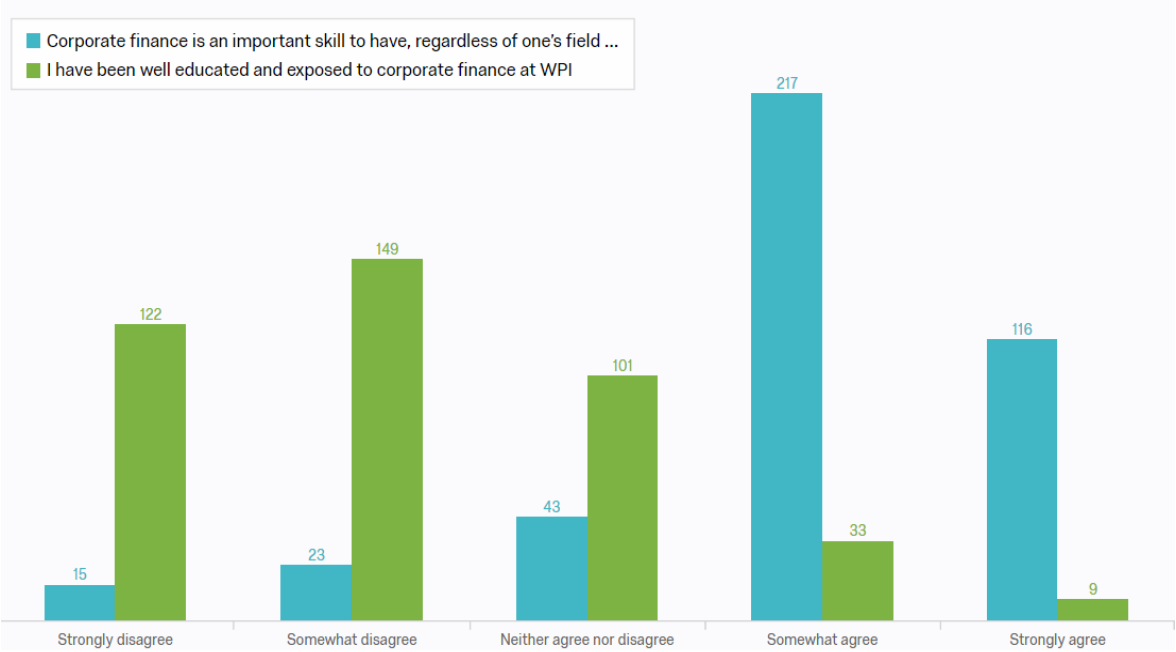

Figure 2: Student Perception on the Importance of Corporate Finance and Exposure at WPI

What role do STEM institutions play in educating their students about corporate finance?

Hypothesis 3: We predict that institutions have the tools to educate students about corporate finance; however, they do not reach a large portion of the student body.

We analyzed the student responses of question 5_b, as seen in Figure 2, and found that there is a general disagreement to the following statement: I have been well educated and exposed to corporate finance at WPI (mean = 2.15 on a scale 1 to 5, with a SD=0.983). This result provides support for Hypothesis 3. Also, conducted a t-test between students that disagreed with the above statement (Case 5, N=250) against those who did not disagree (Case 6, N=127) and found the latter group reported significantly higher knowledge of the six corporate finance topics.

Table 6: Mean of Self-Reported Knowledge of Cases 5 and 6

Topic	Financial Documents	Bonds	Time Value of Money	Corporate Taxes	Venture Capital	Angel Investors
Case 5	2.28(1.015)	1.81(1.035)	2.48(1.113)	1.51(0.808)	1.46(0.831)	1.35(0.763)
Case 6	2.60(0.986)	2.05(0.881)	2.83(1.125)	1.97(0.951)	1.90(1.022)	1.76(1.037)
T, P values	2.907, 0.004	2.347, 0.020	2.947, 0.003	4.923, 0.000	4.212, 0.000	3.888, 0.000

Regarding student on-campus involvement with business or entrepreneurship clubs and societies, we found that only 5.3% of those who answered the survey are or have been involved at WPI. Additionally, only 13% of students answered the survey have taken a course related to corporate finance at WPI. However, as mentioned in the answer to our second research question, these two groups reported higher knowledge levels than the rest of the survey participants. Therefore, we conclude that WPI has the tools to educate and expose students to corporate finance topics, but few students take advantage of these tools.

How do STEM students want to obtain their knowledge about corporate finance?

Hypothesis 4: We predict that students would want it to be integrated into major-specific courses due to the lack of free space in their course schedule to take electives.

In our survey, 86% of students showed their interest in learning about corporate finance now or in the future. These students indicated their preferred method of obtaining knowledge about corporate finance by choosing one out of five categories. As shown in figure 2, integration into major-specific courses was the most popular response (32.5%), followed by workshops and/or seminars (30.5%).

In addition to answering our research questions, our data analysis provided some interesting findings we explored further.

4.1.4 Additional Analysis

An additional topic covered by our survey was student interest in starting a business. While knowledge and views on corporate finance did not seem to change between years, business interest did. A t-test ($t = 2.166$, $p = 0.031$) revealed that upperclassmen (N=176) answered “I have no desire to start my own business” at a significantly higher rate than underclassmen (N=201), while underclassmen answered that they were unsure in larger numbers. This result could be due to the pressure for upperclassmen to find and pursue full time occupation at an established business. It is important to note these result are not concluded from a paired t-test.Another interesting fact is that out of those is who had no desire in starting a business (N = 141), 95% (N = 134) included lack of interest as part of theiranswer. Another predictor of interest is starting a business is in fact, gender. Female participants were significantly less likely to want to start a business, with 52.2% saying no, than male participants of which only 22.8% said no.

Additionally, since several majors at WPI include some amount of business or entrepreneurship courses in their current curriculum, majors such as Actuarial Math, Industrial Engineering, Management Engineering, and Management Information Systems, we decided to see if a significant difference between them and the rest of sample exists. Findings show that the mean of perceived knowledge of students in these majors (Group 1), on average, are higher. While not all the p-values meet the significance threshold, it is possible they would with an increased sample size.

Table 7: Means of Self-Reported Knowledge of Group 1

Topic	Financial Documents	Bonds	Time Value of Money	Corporate Taxes	Venture Capital	Angel Investors
Group 1	2.95(.887)	2.10(.968)	3.25(1.070)	2.10(1.017)	2.00(1.124)	1.85(1.226)
T, P values	2.566, .011	.980, 0.328	2.682, 0.008	2.282, 0.023	1.976, 0.049	1.376, 0.184

One unsurprising result is that students who reported having never learned about corporate finance (N=144) reported lower knowledge than the rest of students (N=233). Untabulated t-tests show p values of less than 0.0005 for all six corporate finance topics between these two groups.

Interestingly, students who reported higher exposure to corporate finance at WPI were more likely to have a higher perception of its importance (N=377, p=0.001, r=0.176). While the correlation itself is not incredibly strong, it is significant.

4.2 Qualitative Data Analysis

In this section, we will be analyzing the qualitative data collected from our interviews. To start, we needed to transcribe information from interviews (See Appendix E). This allowed us to focus on the meaningful and valuable information from interviews. We analyzed each interview using conventional content analysis, which is used in research whose main goal is to describe a phenomenon when existing literature is limited. This method allows important themes to flow from the data rather than having a preconception of the important themes. Additionally, this method allows us to gain direct information that is based on the interviewee's unique perspective and grounded in the actual data (Hsieh & Shannon, 2005).

4.2.1 Qualitative Results

While background research of literature and student surveys are an effective and vital element to the topic of business financial intelligence in WPI students, firsthand accounts from business owners, alumni, and professors offer an alternate perspective and provide insight into the issue. Alumni Todd Alexander, Joe Bush, and Dalita Tomellini, along with Professors Jerome Schaufeld and Curtis Abel were interviewed and asked about their past experiences along with their perspectives on WPI's role in teaching business financials. Although many of these interviewees had different backgrounds and experiences, their collective responses aligned almost without exception and are a great illustration of the role of business financial intelligence both in the corporate world and at WPI.

As a result of their experience and expertise here on campus, Professors Jerome Schaufeld and Curtis Abel were interviewed to see how they felt about WPI's effectiveness, as well as their role in the education of business financials. As whole, each of the professors agreed that business financial knowledge is important for engineers, whether or not they would like to start their own business upon graduation. Despite each of their roles in this education, each professor also stated that business financial intelligence is very low at WPI, and that while there is an effort being made, it can and should be increased to better prepare students for their careers.

In order to effectively grasp the relevance of our topic after graduation from WPI, we also interviewed alumni Todd Alexander, Joe Bush, and Dalita Tomellini as they have each led very different yet impactful careers after their time at WPI. Following their engineering undergrads, they took separate paths. Todd Alexander pursued further education from WPI in both masters and PhD programs, and went on to start his own biotechnology business this past fall. After graduating in 2004, Joe Bush also went back to school for multiple masters degrees and spent twelve years in many different positions working with entrepreneurs and small business owners to develop their startups.

As the only interviewee without graduate education, Dalita Tomellini spent ten years in industry as a design engineer and went on to start her own business in 1999 and is still operating as co-owner and vice president today. Each of these alumni took different avenues to advance their financial intelligence, however, none of them said that they learned it as undergraduates at WPI. Similarly, they each said in separate statements that they felt that the knowledge that they gained was paramount to the advancement of their careers both in and out of engineering. As business owners, Todd Alexander and Dalita Tomellini both noted that they found difficulties properly understanding and generating cash flow to allow for their business to progress. Additionally, Dalita Tomellini made it very clear that as her business quickly grew so did her need for financial knowledge, particularly with investors and allocation of equity.

As a whole, these interviews proved to be an excellent source for our group to further our investigation into the topic of WPI's education on business financials. During her interview, Dalita Tomellini summed up her perspective on the issue stating that, "The qualities of a good engineer are the same as that of a good business owner. WPI makes a lot of good engineers, they are just missing the tools to become good business owners". With so many talented and motivated engineers, it is imperative that we advance our programs and enable our students to become as successful as possible in their futures.

5.0 Conclusions, Recommendations, and Societal Impact

The intention of this project was to investigate and evaluate if engineers lack adequate knowledge of corporate finance and how to better teach business skills. From our background research, we show that entrepreneurship is important and beneficial on the individual, organizational, and national levels. We also establish corporate finance knowledge's direct effect on entrepreneurial activities, such as startups. This IQP shows the students' perception of their corporate finance knowledge and explores the role of STEM institutions in educating their students about corporate finance. Overall, we found that students' self-reported knowledge is low and that institutions, such as WPI, have the resources to educate their students about corporate finance, but many students do not take advantage of it.

Our research suggests that, according to WPI students, the skills and knowledge gained from corporate finance education are important and beneficial regardless of their field of interest. We discovered that WPI students do not gain a significant amount of corporate financial knowledge over their four years of pursuing a STEM degree. There was no significant difference between upperclassmen and underclassmen self-reported knowledge, which shows that corporate finance education is not emphasized throughout the WPI curriculum.

Additionally, we found that most STEM students are interested in learning more about corporate finance either now or in the future. This shows that most students are either not aware of how they can learn about it, or they lack the space and time in their curriculum to learn about it. This explains why the plurality of students selected "integrated into major-specific courses" as their preferred method of learning about corporate finance. They also might be unaware of the entrepreneurial opportunities available to the student body through either clubs or faculty initiatives.

We also found that those who have taken one or more WPI courses related to corporate finance reported higher on their perceived knowledge, which suggests that WPI courses seem to be effective. Moreover, students who have been involved in entrepreneurship clubs or societies reported higher on their corporate finance knowledge. The above findings suggest that students are either not aware about WPI resources or they do not have the time to learn about corporate finance.

We recommend that WPI students should be exposed to corporate financial through a variety of avenues. One direction could be to increase general awareness and publicity of corporate finance, particularly during the first two years of enrollment. Another option is to improve integration of educational disciplines. This can be carried out through an emphasis on multidisciplinary projects, including introductory courses, GPS, IQP and MQP. For example, MQP projects could incorporate further considerations to developing a theoretical business plan. Furthermore, both students and faculty should have better access to resources involving

corporate finance. This could be as simple as a website page providing links to reputable resources for further personal research.

This project also opens a gateway into further research regarding the gap in corporate finance education. Future projects could look into the development of an entrepreneurial engineering curriculum and identifying if specific majors are at more of an advantage to gaining corporate financial knowledge through their existing coursework. More research could be conducted regarding the best way to teach engineers about corporate finance topics. Further work could capitalize on the initiatives already started by the KEEN Foundation to promote entrepreneurial minded engineers. Additionally, future projects can work with the Tech Advisors Network (TAN), which provides advising and networking services to support innovators and entrepreneurs, to help WPI promote the delivery of corporate finance education.

Our findings have greater implications outside of WPI. By examining the gap in the educational structure of engineers, we can better prepare engineers for the workforce. The skills involved in corporate finance are beneficial to engineers, even if they are following a more traditional career path that does not involve a startup. Providing direction to educators can help more effectively educate and prepare engineering students for both problems and opportunities in their future careers.

5.1 Team Reflections

Coming into this project, none of our team members had encountered corporate financial intelligence at any depth. We were all intrigued by the subject, but weren't clear on the direction we were going or what we had gotten ourselves into. After working together for two terms, not only did we increase our own knowledge, but also became increasingly aware of a larger issue at hand regarding the development of an aware engineer. We each gained new personal perspectives and realized the immense impact of corporate finance on our peers.

Appendix

A. Financial Terms Glossary

Angel Investor also called informal investors, angel funders, private investors, seed investors or business angels. These are affluent individuals who inject capital for startups in exchange for ownership equity or convertible debt.

Assets valuable resources, or properties and property rights owned by an individual or business enterprise

Balance sheet an itemized statement that lists the total assets, liabilities and net worth of a given business to reflect its financial condition at the given moment

Business plan a set of guidelines that acts as the operating tool that can aid in properly managing a business and working towards its success while communicating goals to others and providing a basis for financial proposal

Capital funds are funds needed for the base of a business, usually put into the business in a permanent form such as fixed assets, plant and equipment or other ways that are not recoverable in the short term unless the business is sold

Cash flow actual movement of cash within a business, cash inflow minus cash outflow, term used to designate the reported net income of a corporation plus amounts charged off for depreciation, depletion, amortization and extraordinary charges to reserves which are bookkeeping deductions and not actually paid in cash. It is a better indication of the ability of a firm to meet its own obligations and pay dividends rather than a conventional net income figure

Equity is what remains after the liabilities of the company have been subtracted from the assets, thus it may be greater or less than the capital invested in the business, often investment carries a share in ownership and a share in profit

Income statement statement of income and expenses for a given period of time

Venture Capitalist an investor who either provides capital to startup ventures or supports small companies that wish to expand but do not have access to equities markets.

B. Survey Questionnaire

Survey Questionnaire:

1. I am currently a:

a. Freshman (First-year Student)
b. Sophomore (Second-year Student)
c. Junior (Third-year Student)
d. Senior (Fourth-year Student)
e. Graduate Student/Post-Graduate

2. I am currently:

a. A domestic student (i.e., a U.S. citizen or permanent resident of the U.S.)
b. An international student
c. I prefer not to answer

3. Please select the response that best describes your current situation:

a. I currently have my own business.
b. I would like to start my own business right out of graduating college.
c. I would like to start my own business in the next 5 years after graduating college.
d. I would like to start my own business in the next 10 years after graduating college.
e. I have no desire to start my own business at this time (If this option was chosen, the survey directed to an optional question 3a).
f. I am not sure about whether I want to start a business.

3a. Please select all that apply: I have no desire to start my own business because of (only asked if the participant chose option e for question 3)

a. Lack of knowledge on how to start a business
b. Lack of interest in starting a business
c. All the above
d. Other (Please specify)

4. Please select the response that best describes your current situation:

a. I am currently part of an entrepreneurship club or society at WPI
b. I was, but no longer, a part of an entrepreneurship club or society at WPI
c. I am/was part of an entrepreneurship club or society outside of WPI
d. I was never part of an entrepreneurship club or society at WPI (skip to question 5)

4a. I have been a part of one of the following entrepreneurship clubs:

a. Genius Entrepreneurship Club (GEC)
b. Investing Association (IA)
c. Enactus

d. Tech Entrepreneurs
e. Other (please specify)

According to Investopedia, the definition of *corporate finance* is "financial activities related to running a corporation utilizing long-term and short-term financial planning." Using this definition about corporate finance, please answer the following questions:

To what extent do you agree with the following statements:

5. Corporate finance is an important skill to have, regardless of one's field of interest.

1. Strongly disagree
2. Somewhat disagree
3. Neither agree nor disagree
4. Somewhat agree
5. Strongly agree

I have been well educated and exposed to corporate finance at WPI

1. Strongly disagree
2. Somewhat disagree
3. Neither agree nor disagree
4. Somewhat agree
5. Strongly agree

6. Identify your level of understanding about the following topics:

Financial Documents (i.e., income statements, balance sheets, etc.)
Bonds
Time Value of Money (present/future)
Corporate Taxes
Venture Capital
Angel Investors

1. Not knowledgeable at all
2. Slightly knowledgeable
3. Moderately knowledgeable
4. Very knowledgeable
5. Extremely knowledgeable

7. Please select all that apply: I have learned about corporate finance through

a. My own research
b. WPI courses
c. On-campus clubs or societies

d. Online classes or lectures (not at WPI)
e. Previous work experience
f. Other (Please specify)
g. I have not learned about corporate finance at all

7a. How many corporate finance related course have you taken? (Only asked if option b was selected in question 7)

a. 1
b. 2
c. 3 or more

7b. From the previous methods, which one was the most helpful in learning about corporate finance: (Only asked if more than one option was selected in question 7)

a. My own research
b. WPI courses
c. On-campus clubs or societies
d. Online classes or lectures (not at WPI)
e. Previous work experience
f. Other (Please specify)
g. I have not learned about corporate finance at all

7c. From the previous methods, which one was the least helpful in learning about corporate finance: (Only asked if more than one option was selected in question 7)

a. My own research
b. WPI courses
c. On-campus clubs or societies
d. Online classes or lectures (not at WPI)
e. Previous work experience
f. Other (Please specify)
g. I have not learned about corporate finance at all

8. Would you be interested in learning more about corporate finance?

a. Yes
b. Not right now, but in the future
c. No (optional: specify why)
d. I am not sure

8a. Please explain why you are not interested in learning more about corporate finance: (Fill in the blank question)

8b. What would be your preferred method to learn about corporate finance? (Only asked if options a, b, or d are selected for question 8)

a. Integrated into major-specific courses
b. Classes specifically for entrepreneurship and corporate finance
c. Online tutorials/lectures
d. Workshops and/or seminars
e. Other (specify)

9. Are you currently pursuing a STEM (Science, Technology, Engineering, and Mathematics) degree?

a. Yes
b. No
c. I am not sure (e.g. undecided)

9a. Please select your major: (Pulldown menu options, Only asked if option a was selected for question 9)

Major 1

a. Actuarial Mathematics
b. Aerospace Engineering
c. Applied Physics
d. Architectural Engineering
e. Biochemistry
f. Bioinformatics & Computational Biology
g. Biology & Biotechnology
h. Biomedical Engineering
i. Chemical Engineering
j. Chemistry
k. Civil Engineering
l. Computer Science
m. Economic Science
n. Electrical & Computer Engineering
o. Environmental Engineering
p. Industrial Engineering
q. Interactive Media & Game Design
r. Management Engineering
s. Management Information Systems
t. Mathematical Sciences
u. Mechanical Engineering
v. Other
w. Physics
x. Psychological Science
y. Robotics Engineering

z. Society, Technology and Policy
aa. System Dynamics
ab. Undecided

Major 2 (if applicable)

a. N/A
b. Actuarial Mathematics
c. Aerospace Engineering
d. Applied Physics
e. Architectural Engineering
f. Biochemistry
g. Bioinformatics & Computational Biology
h. Biology & Biotechnology
i. Biomedical Engineering
j. Chemical Engineering
k. Chemistry
l. Civil Engineering
m. Computer Science
n. Economic Science
o. Electrical & Computer Engineering
p. Environmental Engineering
q. Industrial Engineering
r. Interactive Media & Game Design
s. Management Engineering
t. Management Information Systems
u. Mathematical Sciences
v. Mechanical Engineering
w. Other
x. Physics
y. Psychological Science
z. Robotics Engineering
aa. Society, Technology and Policy
ab. System Dynamics

Minor (if applicable)

a. N/A
b. Actuarial Mathematics
c. Aerospace Engineering
d. Applied Physics
e. Architectural Engineering
f. Biochemistry
g. Bioinformatics & Computational Biology
h. Biology & Biotechnology
i. Biomedical Engineering

j. Chemical Engineering
k. Chemistry
l. Civil Engineering
m. Computer Science
n. Economic Science
o. Electrical & Computer Engineering
p. Environmental Engineering
q. Industrial Engineering
r. Interactive Media & Game Design
s. Management Engineering
t. Management Information Systems
u. Mathematical Sciences
v. Mechanical Engineering
w. Other
x. Physics
y. Psychological Science
z. Robotics Engineering
aa. Society, Technology and Policy
ab. System Dynamics

9b. What is your major? (Fill in the blank, Only asked if option b was selected for question 9)

10. Please select your gender:

a. Male
b. Female
c. Prefer not to answer

Thank you for your time and cooperation in completing this survey. If you have any questions or comments about this study, please feel free to contact:

Corporate Financial Intelligence IQP Team
fipro@wpi.edu

Additionally, if you would be willing to provide more information about your knowledge or experience with corporate finance or if you would like to know the results of the survey, please follow the link below (link was provided). Again the responses to this survey are still anonymous, confidential, and will not be linked to your personal information.

C. Statistical Analysis

Independent sample t-test, students who have taken courses related to corporate finance (group 1) vs students who have not (group 0) covering six financial topics

Group Statistics

	Please select all that apply:...	N	Mean	Std. Deviation	Std. Error Mean
Financial Documents (i.e., income statements, balance sheets, etc.)	0	331	2.29	.979	.054
	1	46	3.09	1.007	.149
Bonds	0	331	1.84	.989	.054
	1	46	2.24	.947	.140
Corporate Taxes	0	331	1.64	.871	.048
	1	46	1.85	.965	.142
Venture Capital	0	331	1.53	.861	.047
	1	46	2.13	1.166	.172
Angel Investors	0	331	1.43	.819	.045
	1	46	1.91	1.189	.175
Time value of money (present vs future)	0	331	2.52	1.113	.061
	1	46	3.17	1.081	.159

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Financial Documents (i. e., income statements, balance sheets, etc.)	Equal variances assumed	.066	.797	-5.156	375	.000	-.797	.155	-1.101	-.493
	Equal variances not assumed			-5.045	57.452	.000	-.797	.158	-1.113	-.481
Bonds	Equal variances assumed	.137	.712	-2.579	375	.010	-.399	.155	-.704	-.095
	Equal variances not assumed			-2.664	59.471	.010	-.399	.150	-.699	-.099
Corporate Taxes	Equal variances assumed	.471	.493	-1.514	375	.131	-.210	.139	-.484	.063
	Equal variances not assumed			-1.401	55.668	.167	-.210	.150	-.511	.091
Venture Capital	Equal variances assumed	12.426	.000	-4.215	375	.000	-.599	.142	-.878	-.319
	Equal variances not assumed			-3.357	52.027	.001	-.599	.178	-.957	-.241
Angel Investors	Equal variances assumed	14.049	.000	-3.530	375	.000	-.484	.137	-.754	-.214
	Equal variances not assumed			-2.674	51.089	.010	-.484	.181	-.847	-.121
Time value of money (present vs future)	Equal variances assumed	.680	.410	-3.766	375	.000	-.657	.175	-1.000	-.314
	Equal variances not assumed			-3.849	59.049	.000	-.657	.171	-.999	-.316

Independent sample t-test, students who been involved in clubs centered in business (group 0) or

Group Statistics

	VAR00002	N	Mean	Std. Deviation	Std. Error Mean
Financial Documents (i. e., income statements, balance sheets, etc.)	.00	28	2.39	.916	.173
	1.00	349	2.39	1.024	.055
Bonds	.00	28	2.43	1.289	.244
	1.00	349	1.85	.952	.051
Corporate Taxes	.00	28	1.61	1.031	.195
	1.00	349	1.67	.873	.047
Venture Capital	.00	28	2.14	1.113	.210
	1.00	349	1.56	.894	.048
Angel Investors	.00	28	2.07	1.245	.235
	1.00	349	1.44	.834	.045
Time value of money (present vs future)	.00	28	2.79	1.166	.220
	1.00	349	2.58	1.126	.060

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Financial Documents (i. e., income statements, balance sheets, etc.)	Equal variances assumed	1.050	.306	.030	375	.976	.006	.200	-.387	.399
	Equal variances not assumed			.033	32.652	.974	.006	.182	-.364	.376
Bonds	Equal variances assumed	6.593	.011	3.029	375	.003	.583	.193	.205	.962
	Equal variances not assumed			2.344	29.413	.026	.583	.249	.075	1.092
Corporate Taxes	Equal variances assumed	.302	.583	-.348	375	.728	-.060	.174	-.403	.282
	Equal variances not assumed			-.302	30.193	.765	-.060	.200	-.469	.348
Venture Capital	Equal variances assumed	2.657	.104	3.248	375	.001	.581	.179	.229	.933
	Equal variances not assumed			2.695	29.861	.011	.581	.216	.141	1.022
Angel Investors	Equal variances assumed	12.883	.000	3.687	375	.000	.630	.171	.294	.966
	Equal variances not assumed			2.631	28.976	.013	.630	.239	.140	1.120
Time value of money (present vs future)	Equal variances assumed	.002	.965	.921	375	.358	.204	.222	-.232	.640
	Equal variances not assumed			.893	31.174	.379	.204	.228	-.262	.670

entrepreneurship vs students who have not (group 1) covering six financial topics

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Corporate finance is an important skill to have, regardless of one's field of interest	Between Groups	1.694	3	.565	.618	.604
	Within Groups	340.709	373	.913		
	Total	342.403	376			
I have been well educated and exposed to corporate finance at WPI	Between Groups	6.095	3	2.032	2.119	.097
	Within Groups	357.587	373	.959		
	Total	363.682	376			
Financial Documents (i.e., income statements, balance sheets, etc.)	Between Groups	3.761	3	1.254	1.219	.303
	Within Groups	383.697	373	1.029		
	Total	387.459	376			
Bonds	Between Groups	.074	3	.025	.025	.995
	Within Groups	369.247	373	.990		
	Total	369.321	376			
Time value of money (present vs future)	Between Groups	.484	3	.161	.126	.945
	Within Groups	478.232	373	1.282		
	Total	478.716	376			
Corporate Taxes	Between Groups	1.535	3	.512	.652	.582
	Within Groups	292.683	373	.785		
	Total	294.218	376			
Venture Capital	Between Groups	3.018	3	1.006	1.183	.316
	Within Groups	317.094	373	.850		
	Total	320.111	376			
Angel Investors	Between Groups	3.608	3	1.203	1.544	.203
	Within Groups	290.589	373	.779		
	Total	294.196	376			

Analysis of variance test covering perception of importance of corporate finance, exposure to corporate finance at WPI, and six corporate finance topics checking for significant differences in means across class years

Group Statistics

	I have been well educated and exposed to corporate finance at WPI	N	Mean	Std. Deviation	Std. Error Mean
Financial Documents (i.e., income statements, balance sheets, etc.)	>= 3	127	2.60	.986	.088
	< 3	250	2.28	1.015	.064
Bonds	>= 3	127	2.05	.881	.078
	< 3	250	1.81	1.035	.065
Time value of money (present vs future)	>= 3	127	2.83	1.125	.100
	< 3	250	2.48	1.113	.070
Corporate Taxes	>= 3	127	1.97	.951	.084
	< 3	250	1.51	.808	.051
Venture Capital	>= 3	127	1.90	1.022	.091
	< 3	250	1.46	.831	.053
Angel Investors	>= 3	127	1.76	1.037	.092
	< 3	250	1.35	.763	.048

T-test between students who disagree with the statement made in survey question 5_b (=> 3) against those who did not (< 3), testing for significant difference in mean response to knowledge level of six corporate finance topics

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Financial Documents (i.e., income statements, balance sheets, etc.)	Equal variances assumed	.000	.988	2.907	375	.004	.318	.110	.103	.534
	Equal variances not assumed			2.934	259.960	.004	.318	.109	.105	.532
Bonds	Equal variances assumed	4.730	.030	2.227	375	.027	.239	.107	.028	.450
	Equal variances not assumed			2.347	292.113	.020	.239	.102	.039	.440
Time value of money (present vs future)	Equal variances assumed	.159	.691	2.947	375	.003	.359	.122	.119	.598
	Equal variances not assumed			2.936	250.968	.004	.359	.122	.118	.599
Corporate Taxes	Equal variances assumed	2.063	.152	4.923	375	.000	.461	.094	.277	.644
	Equal variances not assumed			4.669	220.380	.000	.461	.099	.266	.655
Venture Capital	Equal variances assumed	9.798	.002	4.504	375	.000	.442	.098	.249	.634
	Equal variances not assumed			4.212	212.701	.000	.442	.105	.235	.648
Angel Investors	Equal variances assumed	23.617	.000	4.286	375	.000	.404	.094	.219	.589
	Equal variances not assumed			3.888	197.347	.000	.404	.104	.199	.609

T-test between upper (=> 3) and lowerclassmen (< 3) checking for significant difference in mean interest in starting a business

Group Statistics

	I am currently a	N	Mean	Std. Deviation	Std. Error Mean
VAR00003	>= 3	176	2.1932	.81917	.06175
	< 3	201	2.0149	.77767	.05485

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
VAR00003	Equal variances assumed	6.660	.010	2.166	375	.031	.17826	.08231	.01641	.34010
	Equal variances not assumed			2.158	362.600	.032	.17826	.08259	.01584	.34068

T-test between those who have not been educated on corporate finance and those who have for significant differences in mean knowledge of corporate finance topics

Group Statistics

	Please select all that apply: I have learned about corporate finance through - Selected Choice I have not learned about corporate finance at all	N	Mean	Std. Deviation	Std. Error Mean
Financial Documents (i.e., income statements, balance sheets, etc.)	0	233	2.68	.993	.065
	1	144	1.92	.865	.072
Bonds	0	233	2.17	1.022	.067
	1	144	1.44	.745	.062
Time value of money (present vs future)	0	233	2.91	1.102	.072
	1	144	2.10	.985	.082
Corporate Taxes	0	233	1.90	.946	.062
	1	144	1.28	.611	.051
Venture Capital	0	233	1.86	1.035	.068
	1	144	1.19	.477	.040
Angel Investors	0	233	1.69	1.008	.066
	1	144	1.16	.483	.040

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Financial Documents (i.e., income statements, balance sheets, etc.)	Equal variances assumed	8.215	.004	7.590	375	.000	.761	.100	.564	.959
	Equal variances not assumed			7.841	334.205	.000	.761	.097	.570	.952
Bonds	Equal variances assumed	17.780	.000	7.432	375	.000	.730	.098	.537	.923
	Equal variances not assumed			7.991	364.844	.000	.730	.091	.550	.910
Time value of money (present vs future)	Equal variances assumed	1.890	.170	7.201	375	.000	.808	.112	.588	1.029
	Equal variances not assumed			7.395	328.759	.000	.808	.109	.593	1.023
Corporate Taxes	Equal variances assumed	27.815	.000	6.925	375	.000	.612	.088	.438	.786
	Equal variances not assumed			7.636	374.267	.000	.612	.080	.455	.770
Venture Capital	Equal variances assumed	97.595	.000	7.237	375	.000	.664	.092	.484	.844
	Equal variances not assumed			8.449	351.602	.000	.664	.079	.509	.818
Angel Investors	Equal variances assumed	102.930	.000	5.917	375	.000	.531	.090	.355	.708
	Equal variances not assumed			6.870	356.489	.000	.531	.077	.379	.683

Table of student survey majors demographics against WPI major demographics

Major	Total Survey students	Percent survey population	Total WPI students	Percent total population
Aerospace Engineering	25	6.81%	220	5.1%
Actuarial Mathematics	3	0.82%	49	1.1%
Applied Physics	0	0%	7	0.2%
Architectural Engineering	4	1.09%	59	1.4%
Biochemistry	9	2.45%	71	1.6%
Biology & Biotechnology	20	5.45%	143	3.3%
Bioinformatics	4	1.09%	15	0.3%
Biomedical Engineering	28	7.63%	389	9.0%
Chemical Engineering	46	12.53%	336	7.8%
Chemistry	2	0.54%	28	0.6%
Civil Engineering	20	5.45%	178	4.1%
Computer Science	26	7.08%	566	13.1%
Economic Science	0	0%	7	0.2%
Environmental and Stability Science	0	0%	6	0.1%

ECE	28	7.63%	356	8.2%
Environmental Engineering	8	2.18%	77	1.8%
Humanities and Arts	0	0%	4	0.1%
Industrial Engineering	13	3.54%	90	2.1%
IMGD	3	0.82%	102	2.4%
Management	1	0.27%	18	0.4%
Management Engineering	1	0.27%	64	1.5%
MIS	3	0.82%	27	0.6%
Mathematical Sciences	4	1.09%	60	1.4%
Mechanical Engineering	93	25.34%	798	18.5%
Physics	2	0.54%	52	1.2%
Psychological Sciences	0	0%	4	0.1%
Robotics Engineering	20	5.45%	326	7.5%
Undecided	4	1.09%	161	3.7%

D. Interview Questions

Questions for faculty interviewees (Schaufeld, Towner, Keiller, Abel)

- Did you work prior to becoming a professor? If so, doing what?
- Do you view business financial skills as essential for the success of an engineer in the workforce?
    - Which skills are particularly advantageous? Which ones are unnecessary?
- In your experience as an educator, are these skills taught or acquired through any particular coursework or projects here at WPI?
- In what way do you include the development of these skills in your course curriculums if at all?
    - Do students respond well to these methods?
- What is your goal when including these skills in your curriculum?
    - A better level of readiness?
    - Showing students different aspects of a problem to which they are not normally exposed?
- Do your students usually show a high or low level of knowledge on this subject?
- In general, do you think your students are prepared to face real business problems, not just engineering ones?
- Do you encourage students to pursue creating their own business?
    - Why or why not?
- If any of your students have started businesses do you still keep in touch with them?

Questions for WPI alumni interviewees (Foy, Oliver, Tomellini)

- How long ago did you graduate?
- How long ago did you start your business?
    - If there was significant time gap in between graduation and starting your business, how was that spent?
- Where did you acquire your financial skills?
    - On the job?
    - In the workforce before the founding of your business?
    - What role has WPI played in this?
- What would you have preferred to have known prior to starting your business?
    - What were common difficulties you ran into?
    - What was easy to complete?

E. Interview Notes

Dalita Tomellini

- Graduated in 1986
- Started her business Lindon Group Inc. in 1999
- Spent 10 years in industry as a design engineer prior to starting her business
- Spent 3 years as an engineering consultant
- Learned business finance on the job in industry, then learned more on the fly in her business
- WPI gave no education on business finance
- Did not plan on starting a business while she was in college
- Wishes she knew general business accounting, managing risk and managing cashflow
- Business owners need to know:
    - How to raise capital
    - When is it smart to use equity and loans
- Took family loans and put personal money in
- Venture capitalists
    - Be very careful
    - Will try to take a big piece of the pie
    - Will assume that the business is desperate
    - Want to know that you will be successful prior to investing
- Get a mentor
- Use networking to find investors
- Have a buyback plan to get equity back
- Know how to manage lines of credit
- Know when to spend money on lawyers
    - Writing loan contracts to protect yourself
- Her business partner had experience running a business and is a business major
    - They do not have overlapping skills which helped them succeed
    - They do very different things for the company

"Good engineers make good business owners; they are smart, motivated, creative, and used to working alone under pressure. Why wouldn't you give all engineers the tools to become a business owner?"

"The qualities of a good engineer are the same as that of a good business owner. WPI makes a lot of good engineers, they are just missing the tools to become good business owners."

Todd Alexander

- WPI Grad and current PhD student
- Igert Fellow
- Created own PhD in innovation and entrepreneurship
- ChE undergrad
- Economics is a part of his studies but not major component
- Was not educated on business finance in his undergrad
- Learned it on his own personal time

- Started his own company in August as an LLC
- NSFI corporate grant for 50k
- Most important awareness
    - Due to lack of time to start
    - Time crunch
- Parents were primary source on financial knowledge
- Foisie building should help but need the actual course to make an impact
- Should be incorporated into MQPs
- "Entrepreneurs in Residence"
- WPI needs introductory corporate finance course

Joe Bush

- WPI '04 Chemical Engineering
- "No Pay MBA"
- Post PhD coordinated academic center in Bronx
- Worked for NSF I Corp program entrepreneurial bootcamp for engineers
- Now runs nonprofit in Worcester for business incubation a year and a half ago
- Has had WPI students as interns however never to use the incubator space
- Reported that he learned effectively nothing about business finance as an undergrad
- Did not have room in his course schedule
- Biggest challenges
    - Start with a solution and end with a problem, should be the opposite
    - Lack of exposure to industry problems
    - Venture forum information session at WPI is a great yet underused resource
- VC/AI are both glamorized investment strategies
- Grant cycle and tenure clock effect student education, how is faculty motivated to find new and better resources for students?
- There is a time and place for invention, not always necessary
- Banks and hard money lenders will not give money without sufficient promise on return
- Most investors will want a business plan prior to investing
- Design entrepreneurs need to make sure that they are designing for manufacture as this influences product cost and as a result producibility
- Need to focus on the end goal of the project

F. Application for Exemption from IRB Review

WORCESTER POLYTECHNIC INSTITUTE
Institutional Review Board
Application for Exemption from IRB Review for
Survey or Interview Research Involving Minimal or No Risk

WPI IRB use only
IRB #
Date:

This application is specifically intended for projects in which students are expected to conduct interviews, surveys or focus groups. *Use of this application is recommended for most student project research involving minimal risk. Proposed research meets the definition of "minimal risk" when the risks to research subjects are not greater than those ordinarily encountered in daily life.*

RESET FORM

Project Faculty Advisor(s):

Name:	Tel No:	E-Mail Address:
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Department: Foisie School of Business		
Jerome Schaufeld	1-508-831-6114	jjs@wpi.edu
Department: Foisie School of Business		

Project Faculty Instructor:

Name:	Tel No:	E-Mail Address:
Fabienne Miller	1-508-831-6128	fabienne@wpi.edu
Department: Foisie School of Business		

Student Investigator(s): *ALL student investigators must be listed.*

Name:	Tel No:	E-Mail Address:
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Joseph Tomellini	4014805557	jjtomellini@wpi.edu

Project Title: Corporate Financial Intelligence

Project Location and Time Frame:

On-campus Worcester, Terms A-B

WPI IRB Application for Exemption from IRB Review for
Survey or Interview Research Involving Minimal or No Risk

Expected Research Subjects: (e.g. museum visitors under the age of 12)

College STEM Students

Project Mission Statement and Objectives

This project will attempt to identify what college students at STEM institutions understand about corporate finance and the impact that it has on starting and sustaining a small business. This project will also investigate the role of STEM institutions in educating students about corporate finance along with the most effective and preferred method of learning. Additionally, we will explore the difficulties encountered by successful entrepreneurs and if a correlation exists between these challenges and the role of STEM institutions in corporate finance education. This investigation should aid in finding the gap between education and corporate finance and providing an analysis of student's preferred learning methods.

Brief Methods Listing: (e.g. "Survey of public to ascertain knowledge and opinions about climate change" or "Interviews of professionals working on climate change regarding effective city climate change program")

A questionnaire survey will gather the majority of our data regarding student knowledge and interest. Through interviews, we will collect the information regarding issues and difficulties of financial education, as interviews can give more in-depth details than a survey questionnaire could. Also we will obtain information through the observation of seminars, workshops, and classes. The surveys, interviews and observations are a necessary part of the data collection because there is a lack of studies regarding the gap of corporate finance education at STEM institutions.

Appendix 1: Attach the draft methodology chapter or statement of research methods.

Appendix 2: Attach a draft of surveys and/or a list of questions to be used for interviews or focus groups. If sample questions are included in Appendix 1, Methodology Chapter, indicate page numbers here.

1. Is the proposed research sponsored or supported by a US federal agency or by US government funding? If so, identify sources. No ☑ Yes ☐
2. Is the proposed research funded by a corporation or foundation? If so, identify sources. No ☑ Yes ☐
3. Does the proposed research involve vulnerable research subjects? (e.g. children, prisoners, students, persons with mental or physical disabilities, pregnant women) No ☑ Yes ☐
4. Does the research involve human subjects in ways other than as participants in interviews, focus groups, or surveys? (e.g. observation of public behavior, use of archived data or experimental procedures) If yes, explain. No ☑ Yes ☐
5. Will the researchers collect information that can be used to identify the subjects? No ☑ Yes ☐
6. Could the disclosure of a human subject's identity and responses place the subject at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability or reputation? No ☑ Yes ☐
7. Will the researchers disclose the identity or the individual responses of any human subjects? (e.g. by quoting an individual, whether or not identified by name or title) No ☑ Yes ☐

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IF you answered yes to question 6 or 7, answer these questions:

A. What is the potential risk to human subjects?

B. How will you eliminate or reduce said risk to an acceptable level?

Please Print Form Before Signing Below

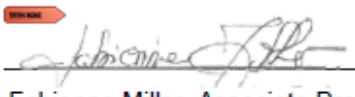
By signing below, all participants in this research project are agreeing to abide by the following instructions:

1. You agree to inform subjects orally or in writing that:
   - Participation in the research is voluntary.
   - Participants may end their participation at any time.
   - Participants need not answer every question in an interview or survey.

2. If your research is **anonymous**, you also inform subjects that you are not collecting names or any identifying information from them.

3. If your research is **confidential**, you inform subjects that no identifying information will be disclosed with individual responses.

4. If your research is **NOT** completely anonymous and confidential, you must obtain each subject's permission to publicly disclose his or her identity and/or responses. All requests for anonymity and confidentiality must be honored. The subject must be offered the opportunity to pre-approve the publication of any quoted material

Signature of Faculty Advisor  Date 03 NOV 16

Print Full Name and Title Fabienne Miller, Associate Professor Foisie School of Business

Please return a signed hard or electronic copy of this application to the WPI IRB c/o Ruth McKeogh, 2nd floor Project Center or irb@wpi.edu.
If you have any questions, please call (508) 831-6699.

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