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Selling Technical Sales to Engineering Learners

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Selling Technical Sales to Engineering Learners

Abstract

Sales engineering or technical sales programs bridge engineering and business to educate engineering students in sales specific to their discipline. Students develop business awareness through such programs, providing the sales workforce with technically knowledgeable salespeople. The following study analyzed cohorts of students enrolled in a technical sales for engineers course to assess the changing perceptions and attitudes of engineering students toward technical sales. Students reported statistically significant changes in perceptions regarding interest, need, and rank of current ability toward technical sales and social skills after completing the course. Student perceptions of sales skills being innate and ingrained decreased. Group analysis – enrollment in the sales minor or previous sales experience – revealed expected differences including higher ranked prior ability and initial interest in sales. A separate analysis of 20 technical sales skills at the end of the course was used to highlight the level students perceived they had achieved each skill.

Keywords

Technical sales education, sales engineering, business awareness

Disciplines

Engineering Education | Sales and Merchandising

Comments

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Selling Technical Sales to Engineering Learners

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ABSTRACT

Sales engineering or technical sales programs bridge engineering and business to educate engineering students in sales specific to their discipline. Students develop business awareness through such programs, providing the sales workforce with technically knowledgeable salespeople. The following study analyzed cohorts of students enrolled in a technical sales for engineers course to assess the changing perceptions and attitudes of engineering students toward technical sales. Students reported statistically significant changes in perceptions regarding interest, need, and rank of current ability toward technical sales and social skills after completing the course. Student perceptions of sales skills being innate and ingrained decreased. Group analysis – enrollment in the sales minor or previous sales experience – revealed expected differences including higher ranked prior ability and initial interest in sales. A separate analysis of 20 technical sales skills at the end of the course was used to highlight the level students perceived they had achieved each skill.

Key words: Technical sales education, sales engineering, business awareness

INTRODUCTION

Engineers design products that are intended to be sold and used by customers. Individuals selling these products don't always have the technical know-how to fully understand the capabilities of the product they are selling (James, 2015). This can limit their ability to provide adequate information



regarding the product to the customer. According to the Bureau of Labor Statistics (2015), there is an increase in the need for sales professionals with engineering expertise to support the sales of an ever-growing market of technical products; specifically they project a 7 percent growth rate from 2014 to 2024. Targeted technical sales courses and programs historically offered to engineering students have been linked to business schools, in particular within marketing programs. The biggest challenge for these programs is balancing the already demanding degree requirements for engineering students with their learning of technical sales skills within academic units that are traditionally different (Narayanan, Sawaya, & Johnson, 2014). New degree programs and minors designed to specifically train engineers in technical sales, sales engineering, and marketing are now beginning to be offered within engineering programs to address this concern. These programs provide disruptive innovations (Behara & Davis, 2015; Christensen, Johnson, & Horn, 2008) that introduce or adapt courses with embedded opportunities for engineering students to develop a base understanding of business, entrepreneurship, sales, finance, distribution, and marketing to develop their transferable business acumen (Creed, Suuberg, & Crawford, 2002; Ferrara, Maguda, & Vavreck, 2007; Sullivan, Carlson, & Carlson 2001; Wang & Kleppe, 2001). Additional efforts have begun to integrate innovation, entrepreneurship, sales, and marketing into the traditional engineering curriculum (Mustar, 2009). The summation of these efforts has led to the creation of leading-differentiated programs that cause disruptive and sustainable innovations, which creatively meet the unique needs of students intending to pursue careers in sales engineering (Behara & Davis, 2015).

The following study investigates and analyzes students enrolled in an introductory technical sales course to better understand the impact such courses have on sales-related learning outcomes. The course is offered by a department of industrial engineering (IE) and was developed with the input and support of the university's business school and industry partners. The course studied is part of a minor program of study which was peer benchmarked against similar programs (e.g., University of Florida, Pennsylvania State University (Erie Campus), Texas A&M University, and Purdue University (Sly, Bumblauskas, & Peters, 2010)). These programs were generally business faculty teaching technical sales versus the studied program in which engineering faculty teach technical sales with guidance from business faculty and an industry consortium. Additional programs in professional and personal sales now exist within engineering technology programs (Weber State, 2016) as well as certificate programs in sales and distribution (Western Carolina University, 2016).

Our study administered a pre-post survey of students enrolled in the technical sales course for five consecutive years to assess perceptions ranging from interest and ability to helpfulness in learning specific technical sales skills. This study builds upon an experimental pilot study (Sly, Bumblauskas, & Carberry 2013) and provides key findings on student sales skills before and after receiving instruction in the topic area of technical sales.



LITERATURE REVIEW

The sales job is an important and ever changing function of business (Jobber & Lancaster, 1997) with an increasing need for salespeople that possess technical and engineering skill sets to communicate information. Case study examples in teaching date back over 50 years (Ruud, 1961), while examples within specific companies, such as GE and DuPont, date back 20 or more years (Anderson, 1996; Wotruba, 1991). Often engineers and those with technical sales skills are enlisted in business-to-business (B2B) and industrial sales and marketing teams (Cardozo & Shipp, 1987; Cardozo, Shipp, & Roering, 1987; Moon & Armstrong, 1994) to help generate and review technical specifications and commercial contracts. B2B sales performance can be measured, but “most students’ job experience... [is] not B2B sales” (Bush, Bush, Oakley, & Cicala, 2014, p. 120).

Murray and Robinson (2001) highlight in their study of sales graduates the difficulty of attracting and retaining knowledgeable graduates for the technical sales workforce. These technical sales jobs also require a wider array of skills and are becoming increasingly difficult for organizations to fill (Allen, Kumar, Tarasi, & Wilson, 2014; Davidson, 2013). The need for comprehensive sales training that develops “personal and enterprise skills” required in sales versus “traditional academic skills” is a key to successfully recruiting students with the “right” knowledge to sell the product. There have been models developed that aim to improve learner knowledge across disciplines to better meet the demands of the workforce when it comes to engineering and management (Verzat, Byrne, & Fayolle, 2009), including commercial business issues such as sales (Thursby, Fuller, & Thursby, 2009). There have also been articles detailing the need for sales engineers to have adequate skills in international projects (Lemaire, 1996), requirements engineering, and specification development with some documented specific cases from the software industry (Driscoll, 2002). Sales teams benefit from having engineers as members, “specifically, the productivity of cross-functional sales teams is increased when the team members have some experience in other functional areas such as the salespeople working for a time in engineering...” (Weitz & Bradford, 1999, p. 249).

Appropriate university education in sales is intended to prepare entry-level employees to be more successful upon initial employment and later for senior positions. This can only be accomplished with more engineering programs offering sales learning opportunities for their students. Murray and Robinson (2001) suggest the importance of integrating sales training earlier in the university curriculum, which is the case with the technical sales for engineers course assessed in this study. Programs must not assume that engineering students are automatically inclined toward proficiency in sales. Research assuming students have basic sales and marketing skills has not held true in the engineering discipline (Hang, Ang, Wong, & Subramanian, 2009). Students often have no sales experience and have not studied related topics in their curriculum. This deficiency can prove to be



problematic for students in technical sales programs or later when they become an employee for their organization. Corporate training programs exist, but generally train sales engineers on company specific products, policies, methods, international processes, paperwork, pipeline reporting, evaluation, behavioral issues, and proprietary intellectual property such as patents, copyrights, and trade secrets. The general foundational knowledge of sales engineering or technical sales is a discipline that extends far beyond the narrowly focused objectives of industry sales and marketing programs. In the sales engineering program investigated in this study, return on investment engineering economic methods and theory are explored at a general level not specific to one organization. Students will go into a variety of situations such as new account sales, existing account sales, and supplier development, which leads to specific corporate training desires. Online learning in corporate programs (Strother, 2002) and in this particular program rely heavily on student and instructor engagement. Programs should assume all students expressing an interest in technical sales enter these courses with either a novice or no understanding to ensure their courses provide students with the necessary background they will need to become successful in sales. This is true even for programs like the one assessed in this study where the students are self-selecting to enroll in the technical sales course and/or minor. Intrinsic motivation and interest in the subject matter have been found to lead to an increase in overall cognition (Mehta, Clayton, & Sankar, 2007), but cannot be assumed to lead to success. Such an approach addresses the concern that “the management component of engineering education remains underdeveloped” (Verzat, Byrne, & Fayolle, 2009, p. 356) and that sales and marketing management are a necessary subset for engineers to understand within the higher level management discipline.

Understanding how businesses work and what is required to effectively sell something is also important beyond preparation toward becoming a sales engineer. Engineering is a business that expects students to be technically, professionally, and commercially competent. Successful professionals must possess both technical knowledge and transferable personal and professional skills, including business awareness, ability to communicate, and teaming skills (Chapman & Martin, 1996; Jones, Brown, Zoltners, & Weitz, 2005; Woods, Felder, Rugarcia, & Stice, 2000). Business awareness includes approaching problems with a business perspective and understanding sales, marketing management techniques, and sales incentive systems (Graen, 2009). Successful business awareness is framed in terms of sales performance (Sujan, Weitz, & Kumar, 1994; Vance, Groves, Paik, & Kindler, 2007), sales performance using longitudinal field testing (VandeWalle, Brown, Cron, & Slocum Jr., 1999), and sales performance combined with self-efficacy (Bolander, Bonney, & Satornino, 2014; Knight, Mich, & Manion, 2014; Krishnan, Netemeyer, & Boles, 2002). Additionally, Wong’s Emotional Intelligence Scale (WEIS) found that “incremental validity” exists between the subject’s emotional intelligence and sales performance (Wong, 2007, p. 144).



Success in management and innovation has been studied and linked to such success factors in business related degrees (Benjamin & O'Reilly 2011; Hill 1992; Hill, Brandeau, Truelove, & Lineback, 2014), but less has been studied related to sales skills specifically for engineers. Engineering education as a whole should assess the success of their students in the area of sales skills as one effort to provide students with learning experiences that afford them opportunities to develop deep conceptual understanding, technical and professional fluency, and authentic practice (Felder & Brent, 2003; Litzinger, Lattuca, Hadgraft, & Newstetter, 2011). Our study fills this gap and uses the previously discussed work as a foundation to study students' perceptions of sales skills for both professional and personal use. We also address a gap in the literature of few studies linking "... students' attitudes toward the subject of the course," in a longitudinal study type format (Rynes & Brown, 211, p. 571).

RESEARCH METHODS

Sample and Academic Program

The experimental group for this study included engineering students enrolled in an introductory technical sales for engineers course, which is part of a sales engineering minor. The minor was initially established and funded in 2008 through a corporate partner grant. The program was developed by faculty and administrators from the Colleges of Engineering and Business in collaboration with an industrial advisory committee comprised of representatives from organizations across a wide array of industries that had and currently hire students from the Colleges of Engineering and Business for career tracks in technical sales and marketing. Additional background on the development of the advisory board and courses, including the syllabi and grading rubrics, is available in a previously published paper (Sly, Bumblauskas, & Peters, 2010).

The overall set of courses that make up the sales engineering minor use a combination of various sales techniques and strategies. Students are required to take two established marketing courses within the College of Business, two engineering specific technical sales courses within the College of Engineering (COE), and one additional economics or finance course offered in the College of Business or Engineering. The sales minor is associated with the COE only and the two technical sales courses are only taught by COE faculty to COE students.

This IRB approved study focuses on the first introductory course in technical sales. The only requirement for sequence is that the first technical sales course come before the second technical sales offering and that students take engineering economics as a pre/co requisite to the first course in technical sales. The two marketing courses can be taken in any order. The two marketing courses



are generally not taken prior to the first technical sales course. One instructor taught the course from the program's inception and throughout the period of data collection. The course is designed to teach the following skills: sales process methodology, techniques for building professional relationships, sales automation software, prospecting and account development, market analysis and segmentation, responding to RFQ's and RFP's in written and verbal form, developing technical value propositions and competitive positioning, evaluating organizational decision processes and people, technical marketing strategies, and sales closing strategies. Students who elected to take this course between the Fall 2010 and Fall 2014 semesters were solicited to complete a pre and post survey. A total of 281 students provided some data; a subset of students who completed both the pre and post assessments ($n = 99$) was used for our analysis for ease of analysis.

The sample of 99 students consisted of juniors (77%) and seniors (21%) (2% unknown) mainly majoring in industrial engineering (70%); other student majors included mechanical (12%), chemical (8%), electrical (2%), civil (2%), biomedical (2%), aerospace (1%), materials (1%), agricultural (1%) and construction (1%) engineering. The majority of students were male (80%) with no prior sales experience (76%). More than half of the students were enrolled in the program's sales engineering minor (60%). Some data (3%) pertaining to gender and year were not provided.

A control group of engineering students ($n = 80$) who did not take the sales course was added to provide a comparative component to the study. The sample consisted of graduating seniors in the IE program. This sample was deemed acceptable because the experimental sample included a high percentage of IE students as well as some seniors. The majority of students enrolled in the sales minor were also enrolled in the IE degree program further supporting the decision to use IE students as a control group. Only 15% of these students reported any prior sales experience.

Data Collection and Analysis

Students enrolled in the sales course were surveyed within the first two weeks (pre) and last week (post) of the course. A new instrument titled the *Sales Engineering Students' Learning Outcomes Survey (SESLOS)* was specifically created for this study. The purpose behind developing a new instrument was to ensure beliefs and technical sales skills assessed aligned with what was taught in the course according to the syllabus as a form of content validity (Appendix A). The first portion of the survey includes six items on a 10-interval Likert scale. Student ranks of each item were collected pre-post and subsequently analyzed using a Wilcoxon Signed Ranks Test to compare population medians for a population that could not be assumed to be normally distributed (Lowry, 2014). The second portion of the survey lists sales skills designed around the sales minor and the course learning objectives. These items were scored on a scale from 0



(not helpful) to 100 (very helpful) because it is a stronger predictor of academic performance (Pajares, Hartley, and Valiante, 2001) based on an individual's common understanding of being typically scored in school on a 100-point scale; scores were later translated to a 1 to 10 scale for comparison with pre-post belief scores. The skill items were not administered to the students until the post-survey. These items were assessed using a simple mean analysis to expand the pre-post beliefs analysis.

The entirety of the instrument utilizes self-assessments as a means to measure success. This approach has been called into question by other researchers as it relates to evaluating student perception (Clayson, 2009) and self-efficacy (Sitzmann, Ely, Brown, & Bauer, 2010). Self-reports were chosen and used in the following study because they provided important and appropriate first-person accounts of how the intervention impacted knowledge or skills gained. The value of these indirect measures is that they allow the respondent to self-assess and provide personal insights. Such an approach is no less valid than academic assessments made using scores and grades on exams, which are subject to rater variability and inconsistent validation of measures.

RESULTS

Student Beliefs

A Wilcoxon Signed Ranks Test analysis of the pre-post data was used to identify change in student beliefs over the course of the class intervention. Analysis indicated that the median post-test ranks for all categories were significantly higher than the median pre-test ranks (see Table 1 for details).

Table 1. Pre-post student belief median (Mdn) scores and Wilcoxon Signed Rank Test (Z) with significance.

Item	Pre Mdn	Post Mdn	Z
Interest in sales as a profession	7	8	-4.02***
Need for sales skills in your life (outside of sales as a profession)	8	9	-4.17***
Importance of sales skills in professional success	9	9	-3.22***
Rank of current sales skills	6	7	-6.69***
Rank of current social skills (i.e. meet new people)	7	7	-3.96***
Rate your level of agreement with the statement that 'sales skills are something you're born with'	6	7	-2.93**

*** $p \leq 0.001$; ** $p \leq 0.01$



Technical Sales Skills

The significant gain in current sales ability/skill can be further broken down through the separate analysis of 20 technical sales skills at the end of the course. A mean analysis of skills taught in the course revealed gains ranging from helpful to very helpful – range of 6.2 to 9.1 – for all items (Table 2). In particular, students found environmental issues, use of simulation, supply chain, constructing a legal contract, and governmental sales as skills the course did not enable them to achieve as well as the other 15 skills. The standard deviations for skills with lower means scores were greater implying less agreement among the student sample.

Within Group Analysis

Additional Mann-Whitney U Tests were conducted to look at within group differences pertaining to sales experience, declaring for the minor in sales engineering, gender, and engineering major.

Table 2. Mean (M) scores with standard deviations (SD) for technical sales skills.

Technical Sales Skill	M	SD
Communication	9.1	1.1
Perform the Selling Process	9.0	1.0
Understanding Customer Needs	9.0	0.9
Identifying a Decision Maker	9.0	1.0
Requirements Gathering	8.3	1.4
Sales Management	8.3	1.7
Pricing Strategies	8.1	1.3
Purchasing	8.0	1.5
Make Financial Decisions	8.0	1.5
Know Stakeholder Roles	7.9	1.4
Marketing Analysis	7.9	1.5
Addressing a Cultural Issue	7.7	2.1
Performing a Sales Call	7.7	2.0
Cross-boundary Selling	7.4	1.9
Leasing	7.2	2.2
Environmental Issues	6.8	2.4
Use of Simulation	6.7	2.7
Supply Chain	6.6	2.4
Constructing a Contract	6.5	2.5
Governmental Sales	6.2	2.6



Table 3. Mean scores for those with and without prior sales experience.

Prior Sales Experience	Interest in Sales as a Profession			Rank of Current Sales Skills		
	Pre M	Post M	Δ	Pre M	Post M	Δ
Yes	7.8	8.0	0.2	6.1	6.8	0.7
No	6.5	7.5	1.0	5.0	6.5	1.5

Students in the sales engineering course with sales experience ($n = 25$) compared to those without ($n = 74$) displayed significantly higher pre-assessments of interest in sales as a profession [$U = 533.0$, $p = 0.021$] and rank of current sales skills [$U = 595.5$, $p = 0.007$] than those without sales experience (Table 3). Both groups increased in their assessment of their beliefs from pre to post, but those without prior sales experience made greater gains. The relative increases resulted in no significant differences at the time of post-assessment. All other items were not significantly different at either time period during the course. This implies that the sales course assisted in developing a sufficient level of interest in sales as a profession as would actual experience.

A comparison was also made between those who declared a minor in sales engineering ($n = 59$) and those who had not ($n = 40$). Again, a difference was seen for the items pertaining to interest in sales as a profession [$U = 539.5$, $p = 0.000$] and rank of current sales skills [$U = 729.5$, $p = 0.001$] (Table 4). Both groups increased in their assessment of their beliefs, while maintaining a significant difference for both interest in sales as a profession [$U = 626.0$, $p = 0.000$] and rank of current sales skills [$U = 890.5$, $p = 0.033$]. All other items were not significantly different at either time period during the course.

Gender comparisons revealed two significant differences – need for sales skills in your life outside of sales as a profession prior to the course [$U = 476.0$, $p = 0.026$] and rank of current social skills after the course [$U = 455.0$, $p = 0.033$]. Both categories displayed higher scores for females than males, but should not be considered completely generalizable due to the male to female ratio (79:18). Studies of gender and

Table 4. Mean scores for those who have or have not enrolled in the sales engineering minor.

Enrolled in Sales Minor	Interest in Sales as a Profession			Rank of Current Sales Skills		
	Pre M	Post M	Δ	Pre M	Post M	Δ
Yes	7.6	8.4	0.8	5.7	6.8	1.1
No	5.8	6.6	0.8	4.7	6.3	1.6



technical sales on attitudes, behavior, and performance have reported mixed results (Siguaw & Honeycutt, 1995), but do show gender differences in terms of their sales approach (O'Hara, Boles, & Johnston, 1991). A comparison of student majors (69 industrial engineering versus 30 other engineering disciplines) revealed no significant differences between groups for any item at either pre or post assessment.

Control Group Comparison

The control group of graduating industrial engineering students from 2013 and 2014 ($n = 80$) was used to assess the self-selection aspect of the sales engineering course. The instructor of the course explains on the first day of the course what would constitute "innate," sales skills as well as "systematic processes." Analysis uncovered that interest in sales [$U = 1119.0$, $p = 0.000$], need for sales skills [$U = 2524.5$, $p = 0.014$], and importance of sales skills [$U = 2039.5$, $p = 0.000$] were found to be significantly different at the time of pre-assessment. These three skills remained significantly different (all $p = 0.000$) at the time of post-assessment for students enrolled in the course. Additionally, rank of current sales skills [$U = 1824.5$, $p = 0.000$], current social skills [$U = 2390.5$, $p = 0.010$], and perception of sales skills being innate [$U = 2427.5$, $p = 0.014$] became significantly different. The results clearly show bias for students to take a course in technical sales who actually have an interest in the subject.

DISCUSSION

The six student beliefs involved tracking student responses at both the beginning and end of the course. All six of the concepts were shown to significantly increase at a minimum of $p \leq 0.01$ between pre and post, with five of the concepts at a minimum of $p \leq 0.001$. Each concept will be broken down by level of significance in the following subsections.

Current Sales Skills

The results show conclusive evidence that students believed their sales skills were enhanced over the period students were enrolled in the course. The significant difference at a $p \leq 0.001$ level provides validation that the curriculum is delivering the desired primary goal of increasing student confidence in their capability for sales.

The additional analysis at the end of the semester of 20 sales skills was meant to elaborate on what the perceived gain in current skills actually entailed. The mean scores ranged from a high of 9.1 to a low of 6.2. The top six highest scoring topics represent the core principles of sales. As such, the course appears to be providing a strong foundation that clearly delivers the most important concepts to the students with little variation across the sample. The five lowest scoring topics represent



opportunities for improvement in the course curriculum, but are not core to developing sales skills. The remaining eight scoring topics include a few concepts of core importance, which could be emphasized more effectively in the course. Notably the concepts of “Performing a Sales Call” and “Effectively Dealing with Purchasing Departments” are clearly important in industry, but very difficult to teach effectively within a classroom environment. These emphasis areas could be improved by developing problem-based learning modules or role-playing vignettes. A greater emphasis on leasing and financial decision-making may offer the greatest opportunity for curriculum improvement. These topics are currently covered in detail within the prerequisite Engineering Economics course in addition to the return on investment (ROI) analysis required in the final project.

Interest in Sales as a Profession

The course significantly increased the desire of students to pursue a career in sales at a $p \leq 0.001$. This was to be expected with nearly 60% of incoming students already wishing to seek sales as a profession per their enrollment in the technical sales minor. One of the industry objectives of this course was to “weed out” students who may not consider sales as a possible career. The survey was not designed to better understand the reasons that students may have changed their career preference, but the survey does conclusively identify an increase in interest.

Current Social Skills

Students came through the course with a significant self-perceived increase in their social skills at a $p \leq 0.001$. The course specifically devotes several weeks towards the objective of improving students’ skills in relationship building and interpersonal bonding. The lack of a higher level of significance may be related to the fact that students, who have self-selected themselves for this course, already had a fairly strong belief in their current skill levels.

Increases in social skills are likely related to the structured way in which personality profiles are determined and corresponding successful human interactions are determined. It is understandable that engineering students tend to relate well to this systematic approach to human bonding.

Need for Sales Skills in Your Life

There is a strong need for sales skills outside of the sales profession (e.g., selling one’s self or family; selling a position, idea, or organization; etc.). Students also indicated ($p \leq 0.001$) that they see a need for sales skills outside of the sales profession. It was encouraging that the mean did increase throughout the course up to a value of 8.7 out of 10, but it was surprising that this concept was already rated by the students at 8.0 prior to taking the class. This finding means that students did not need a great deal of additional evidence on the importance of sales as a life skill.



Innate Sales Skills

Researchers have analyzed the development of innate skills, such as technical sales or sales engineering skills, in a nature versus nurture context for many years. That is, are skills such as technical sales skills something that people have inherently (nature, innate) or are they something that can be amassed by training (nurture)? Mackinnon (1962) cited the impact of nature versus nurture on creativity, which is an important aspect of sales management and engineering education.

Students indicated an expected initial belief that sales skills are something you are born with, i.e., the nature argument. Somewhat surprising was that they continued to believe this at the end of the course. In fact, students increased their belief in this concept from 6.3 to 7.1 ($p \leq 0.01$). The course emphasizes that sales is a systematic process which involves many skills, and that listening is more important than speaking. This is counter to the traditional thought that extroverts always make the most effective sales people. It was expected that these lessons would actually reduce the traditional belief that sales is innate. This finding was obviously not confirmed by the survey results. Sales skills do involve a lot of strategy in terms of identifying which questions to ask, people to speak with, objections to address, and values to drive. Perhaps some students believe that these activities benefit from innate skills.

Importance of Sales Skills in Professional Success

Students came into the course already having a strong perception of sales skills being important for professional success (with a score of 8.4 that rose slightly to 8.9). It is unknown how students came to this initial belief, but clearly the fact that students have elected to take the course would indicate that they understand the importance of sales in their professional or personal lives. The small growth in the mean throughout the semester was one of the two weakest with a statistical significance of $p \leq 0.01$.

CONCLUSIONS, FUTURE WORK, AND IMPLICATIONS

An analysis and comparison of engineering students enrolled in an introduction to technical sales course showed no significant differences other than “interest in sales” and “importance of sales in professional success.” Significant increases in student perceptions regarding interest, need, and rank of current ability toward technical sales and social skills were observed. Differences seen when students were grouped based on enrollment in the sales minor or when students had previous sales experience included ranking their prior ability higher and expressing higher initial interest. A separate analysis of 20 technical sales skills at the end of the course also revealed gains ranging from helpful to very helpful.



The sales course analyzed in this study was shown to increase student confidence and capabilities executing the most important concepts in technical sales. The results provide some practical validation of the course design and verification for employers of student gains in pertinent sales subject matter knowledge. The findings clearly identify that the students who seek a position in technical sales are well informed of their future responsibilities. This choice of studying sales aligns with research that social image, job availability, and aptitude are significant factors impacting students' decisions to select a business component to their degree (Kumar & Kumar, 2012).

There are a number of areas for future work pertaining to technical sales for engineers that we believe would continue to build the foundation established in this paper. First, it would be important to understand why students may change their perceptions towards sales as a profession throughout a technical sales program and how they justify this change. This area of research would benefit from a qualitative examination of current students and alumni to obtain a greater breadth of understanding for why students enroll and eventually pursue careers in sales engineering. A supplemental study of self-efficacy towards a career in sales would also provide additional insights as to the impact confidence may have on these decisions (Peltier, Cummins, Pomirleanu, Cross, & Simon, 2014; Cummins, Peltier, Pomirleanu, Cross, & Simon, 2015). Second, it would be beneficial to follow alumni of technical sales programs to assess how many students actually pursued a career in technical sales relative to their desire to do so at the end of the course. Finally, it would be of interest to capture an understanding of why students still believe that sales skills are innate at the end of the course through an analysis of epistemological beliefs. Capturing student ethnicity may also influence the perceived importance of sales as a field and discipline building on the work of others in this area (Fournier, Chéron, Tanner, Bikanda, & Wise, 2014; Sohail 2004).

This study does, and the proposed future work will, provide a foundation for those developing new technical sales programs. It also provides existing programs considering changes to better understand the preparation of their students. It is imperative with the growing need for technically knowledgeable sales professionals that programs effectively and efficiently prepare their students for the sales profession.

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**APPENDIX A: SALES ENGINEERING STUDENTS' LEARNING OUTCOMES SURVEY (SELOS)**

DIRECTIONS: *Please rank the following from 1 to 10 (1 = low; 10 = high).*

1. Interest in sales as a profession.
2. Need for sales skills in your life (outside of sales as a profession).
3. Importance of sales skills in professional success.
4. How do you rank your current sales skills?
5. How do you rank your current social skills (i.e. meet new people)?
6. Do you think successful sales skills are 1 = innate or 10 = systematic process (rate from 1-10)?

DIRECTIONS: *Rate how helpful the sales engineering course (COURSE CODE) has been in enabling you to achieve the following skills (0 = not helpful at all; 100 = very helpful).*

1. Market analysis (consider a and b)
 - a. Scope and define potential markets
 - b. Develop an effective sales approach for a given market/customer combination
2. Understanding a customer's needs
3. Perform the selling process (consider a - d)
 - a. Relationship building
 - b. Decision points
 - c. Requirements
 - d. Solution building
4. Know the role that the manufacturer and dealer play in supporting customers business
5. Requirements gathering (consider a - d)
 - a. Perform a RFQ review to identify specifications
 - b. Gather and define requirements
 - c. Identify manufacturing/service constraints (in-house, outside vendors, and contractors)
 - d. Preparation and submittal of quotations and proposals
6. Make appropriate financial decisions
7. Pricing Strategies (consider a and b)
 - a. Determine when to use a value added approach vs. a commodity approach
 - b. Determine when to sell on a direct basis vs. through distribution
8. Conduct a structured sales call
9. Expand production and inventory management concepts to broad supply chain issues
10. Accommodate for cultural issues when selling in other countries
11. Financing and leasing (consider a and b)



- a. Support customers in large capital equipment purchases)
- b. Understand dealer and customer risk and solvency in purchasing equipment
12. Construct a legal or contract
13. Purchasing strategies (consider a and b)
 - a. Understand what purchasing agents know
 - b. Being an effective negotiator and solutions provider
14. Communication (consider a - c)
 - a. Presentation: Communicate an effective presentation to a client
 - b. Verbal: active listening, asking appropriate questions, phone and technology etiquette
 - c. Written: identification of your audience, determining best means of communication, using emails, memos, letters, and proposals
15. Use simulation and modeling to support sales i.e. apply a stochastic model of the proposed solution in action
16. Environmental Issues (consider a and b)
 - a. Understand the environmental impacts on customer decisions
 - b. Address environmental issues for customers
17. Sales management including compensation systems
18. Effective cross-boundary selling (decision maker resides outside your territory)
19. Identify the true decision maker in an organization
20. Understand government sales