Student Perceptions on how different course types may influence their career

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Abstract

Which course types do engineering students believe will benefit them the most in their future career? Engineering students have to take many different courses in order to earn an engineering degree. Courses can be mathematics, science focused like chemistry and physics; more technical, major specific; laboratory style with, the majority of the times, hands-on learning experiences; or concentrated to develop students' professional skills. This study focuses on examining students' perceptions on how different course types will help them with their future career. A survey was administered to four groups of students; one taking a technical course with heavy lecture component, one taking a laboratory course with the majority of learning done with hands-on activities, one in a leadership learning course, and another taking a project management, professional skills course. Students were at the sophomore, junior, and senior year. The null hypothesis that there was no difference in perceptions between student groups was not rejected. The findings of this research may enhance professors' understanding of students' motivation in different course types, encourage professors to relate course material to potential future careers, and contribute to engineering curricula improvement.

Keywords

Course assessment; Student Perceptions, Surveys; Career perceptions

Introduction

The Accreditation Board for Engineering and Technology (ABET) requires students to be able to apply principles of science, mathematics, and engineering, recognize ethical and professional responsibilities, and work effectively in teams, among others[1]. Engineering curricula include science courses, mathematics, English, technical courses (major specific), laboratories and often professional skills and management related courses. The first two years of the majority of engineering curricula are heavy in science and math courses[2]. As cultural, social, political and economic changes take place, the curriculum should reflect and respond to changing needs and aspirations of students. Technology Education must be proactive in this arena to meet ever-changing societal needs[3]. Laboratories, historically, play an important role in engineering curricula. The learning goals being; reinforcing conceptual understanding; cultivating professional and social skills; developing students' abilities towards scientific inquiry and engineering design[4]. Research shows that increases in student engagement result in increases in academic achievement and intellectual development but many engineering colleges and programs continue to emphasize basic curriculum courses[5]. Students often cannot see the connection between those courses and engineering and may lose interest in their major. Faculty in the School of Engineering were interested in collecting information that could be used to assess students' perceptions on how different course types will help them with their future career. Specifically there was strong interest in incorporating faculty observation and records as

well as gathering feedback from current students. A survey was administered to four groups of students; one taking a technical course with heavy lecture component, one taking a laboratory course with the majority of learning done with hands-on activities, one in a leadership learning course, and another taking a project management, professional skills course. Students were at the sophomore, junior, and senior year. These surveys were designed to enhance professors' understanding of students' motivation in different course types, encourage professors to relate course material to potential future careers, and contribute to engineering curricula improvement.

Survey Design

A survey was designed to assess which course types engineering students believe will benefit them the most in their future career as well as if they felt that science and technical courses influence their performance in technical courses and laboratories, respectively. In designing the survey instrument, six categories of courses; Science, Math, Technical, Labs, Professional Skills, and leadership were taken into account. The survey questions are listed below.

1) Science courses such as physics, chemistry, and biology will benefit me in my future career.
2) Math courses will benefit me in my future career path.
3) Major specific technical courses will benefit me in my future career path.
4) Laboratory courses with hands-on components will benefit me in my future career path.
5) Professional development courses such as project and engineering management will benefit me in my future career.
6) Leadership focused courses will benefit me in my future career path.
7) I wouldn't be able to be successful in my technical courses if I hadn't taken science courses before.
8) I wouldn't be able to be successful in my laboratory courses if I hadn't taken the related technical course before.

A five point Likert scale was used to obtain a numerical score of the responses, with 5 representing "strongly agree," 4 representing "agree," 3 as "neutral," 2 representing "disagree," and 1 representing "strongly disagree".

Students were also asked to rank the science, math, technical, labs, and professional skills courses from the most important to the least important in terms of the course significance to their future career.

The survey was administered to four groups of students; one taking a technical course with heavy lecture component, one taking a laboratory course with the majority of learning done with hands-on activities, one in a leadership learning course, and another taking a project management, professional skills course. A total of 115 students responded to the survey. Students included sophomores, juniors, and seniors. The survey was not administered to freshmen because they have not taken technical courses or laboratories yet.

Survey Results' Analysis

The 115 surveys were aggregated and the data was analyzed. The student population was split in year of study: sophomores, juniors, seniors, to examine any differences among them. Figures 1-3

present the responses per year for each question. In order to examine if there were significant differences among sophomores, juniors, and seniors, analysis of variance (ANOVA) statistical technique was used. An ANOVA test was performed for all eight questions of the survey. The results are showed in Table 1.

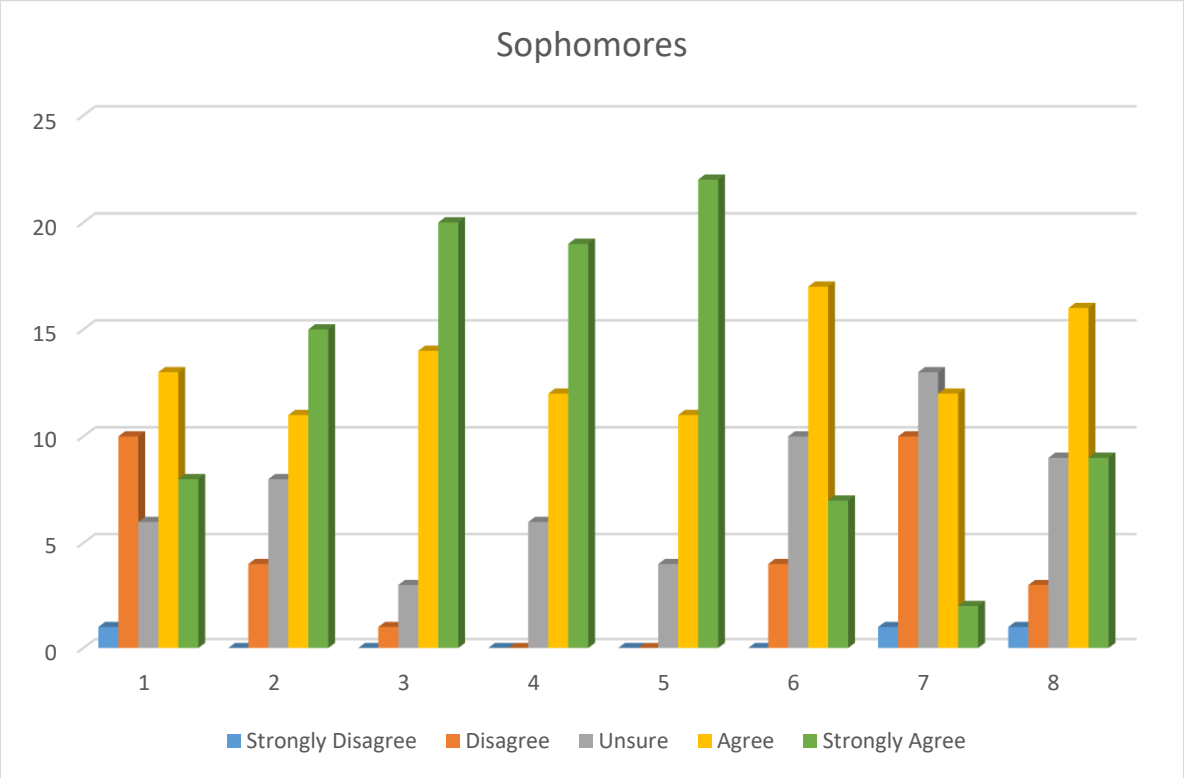

Figure 1. Sophomore Survey Results.

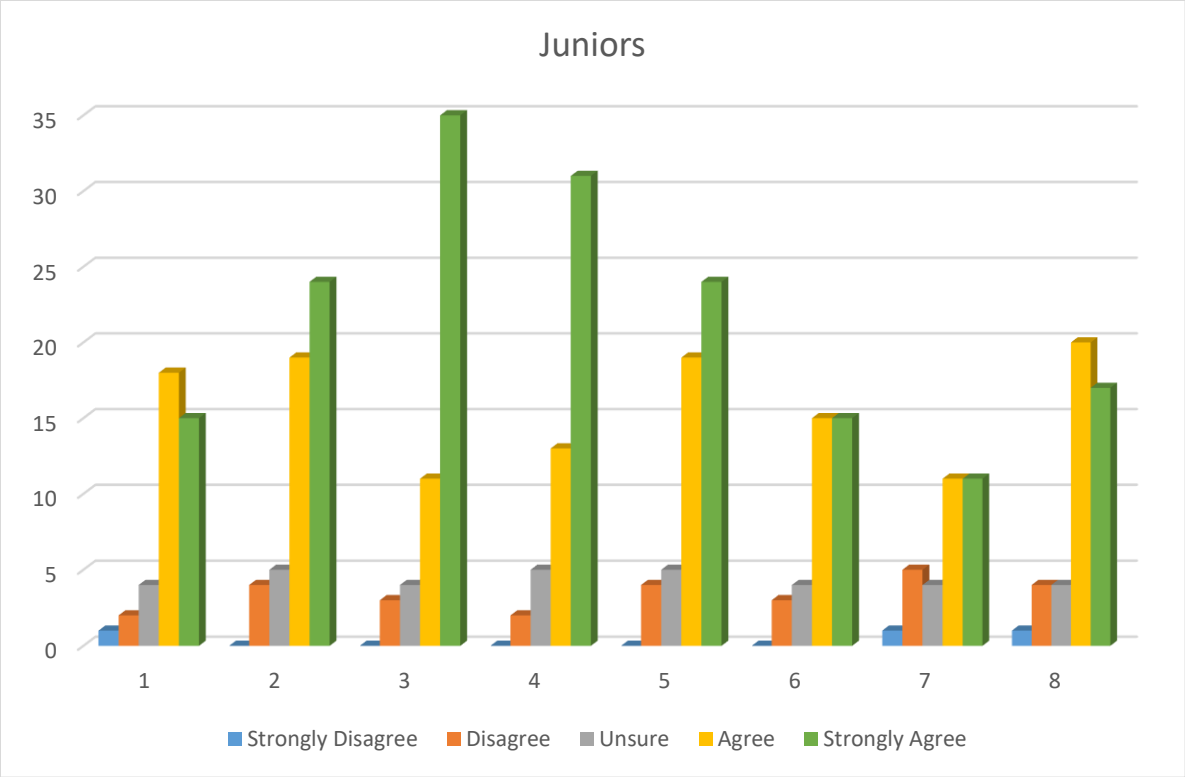

Figure 2. Junior Survey Results.

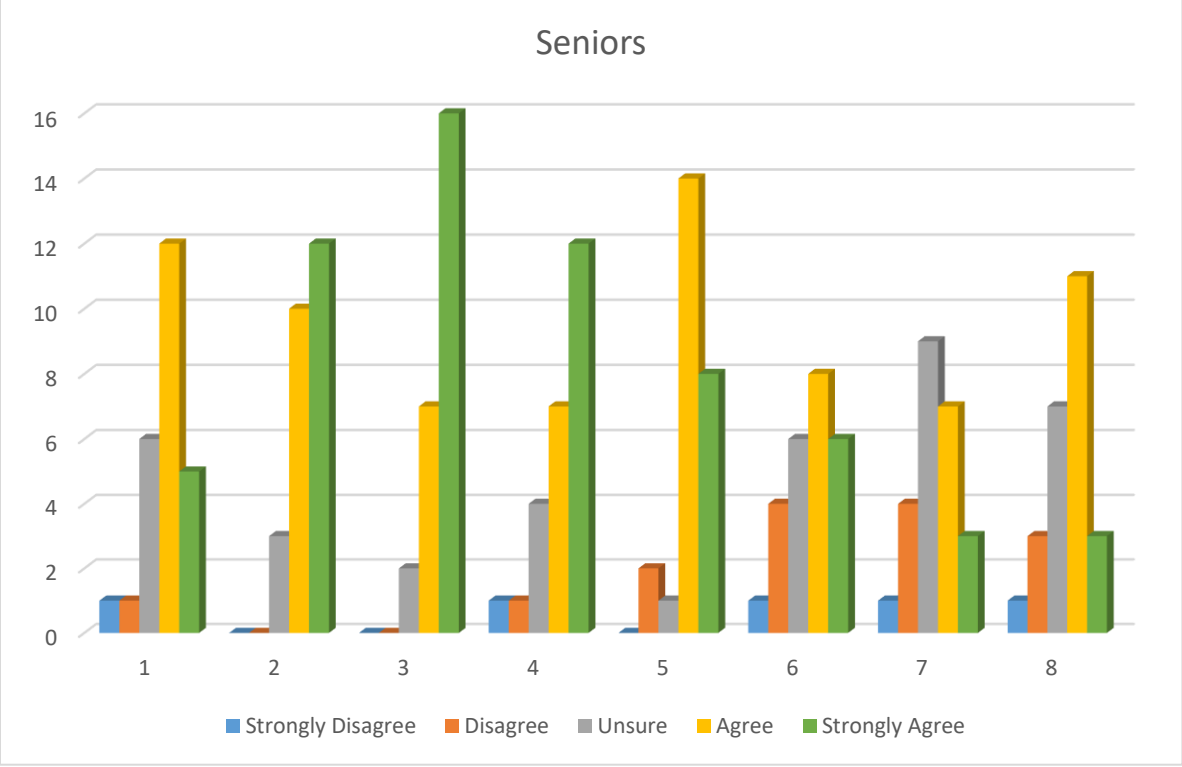

Figure 3. Senior Survey Results.

The F-value determined from the ANOVA test is less than the F-critical value for the selected alpha level of 0.05. Therefore, there is evidence to accept the null hypothesis and say that at least one of the three samples have significantly different means and thus belong to a different population. Another measure for ANOVA is the p-value. If the p-value is more than the alpha level selected (which it is, in our case), the Null Hypothesis is accepted[6].

The majority of the students agree that all courses will benefit them in their career but they strongly agree that the technical, professional skills, and laboratory courses (Q2, Q4, Q5) are more important as indicated with averages above 4.2. They are less sure about the science (Q1) with an average between 3.45 and 3.67, and leadership courses (Q6) with an average between 3.71 and 3.76.

Table 1. Statistical Analysis Results

(a) Questions 1-4

	Sample Size	**Q1**		**Q2**		**Q3**		**Q4**	
Year of study		Average	Variance	Average	Variance	Average	Variance	Average	Variance
Sophomores	38.00	3.45	1.39	3.97	1.05	4.39	0.57	4.37	0.56
Juniors	49.00	3.67	1.68	4.27	0.99	4.59	0.75	4.43	1.00
Seniors	28.00	3.86	0.94	4.39	0.47	4.57	0.40	4.18	1.12
ANOVA									
F		0.99		1.80		0.76		0.64	
P-value		0.38		0.17		0.47		0.53	
F-critical		3.08		3.08		3.08		3.08	

(b) Questions 5-8

	Sample Size	**Q5**		**Q6**		**Q7**		**Q8**	
Year of study		Average	Variance	Average	Variance	Average	Variance	Average	Variance
Sophomores	38.00	4.50	0.47	3.71	0.81	3.11	0.91	3.76	1.00
Juniors	49.00	4.35	0.81	3.76	1.52	3.31	1.72	3.90	1.39
Seniors	28.00	4.21	0.69	3.71	1.40	3.29	1.10	3.61	1.06
ANOVA									
F		1.00		0.02		0.58		0.65	
P-value		0.37		0.98		0.56		0.52	
F-critical		3.08		3.08		3.08		3.08	

The results of how students ranked the science, math, technical, labs, and professional skills courses are shown in Table 2. The numbers are in percent (%).

Table 2. Student course importance' order

(a) Sophomores

	Sophomores				
Course Type	Science	Math	Technical	Labs	Professional Skills, Leadership
Most Important	2.6	13.2	44.7	10.5	28.9
	2.6	7.9	26.3	34.2	28.9
	7.9	23.7	15.8	28.9	23.7
	28.9	36.8	7.9	18.4	7.9
Least Important	57.9	18.4	5.3	7.9	10.5

44.7% of sophomores rated technical courses as the most important for their future and 28.9% of them rated professional skill courses as the most important. Only 2.6% believed that science courses are the most important. The second and third most important courses with 34.2% and 28.9%, respectively were labs, while math were rated as second least important (36.8%) and science courses as the least important (57.9%).

(b) Juniors

	Juniors				
Course Type	Science	Math	Technical	Labs	Professional Skills, Leadership
Most Important	6.1	18.4	51.0	6.1	18.4
	18.4	16.3	24.5	16.3	24.5
	14.3	38.8	12.2	24.5	10.2
	18.4	18.4	10.2	30.6	22.4
Least Important	42.9	8.2	2.0	22.4	24.5

51% of juniors rated technical courses as the most important. Professional courses were rated as the second most important (24.5%) along with the professional courses with exactly the same %. Math courses were placed as the third most important (38.8%), whereas labs as the second least important (30.6%) and science courses again as the least important (42.9%).

(c) Seniors

	Seniors				
Course Type	Science	Math	Technical	Labs	Professional Skills, Leadership
Most Important	7.1	32.1	32.1	3.6	25.0
	10.7	10.7	39.3	25.0	14.3
	14.3	17.9	14.3	25.0	28.6
	17.9	21.4	14.3	28.6	17.9
Least Important	50.0	17.9	0.0	17.9	14.3

Interestingly, seniors rated math and technical courses equally as most important with 32.1%. Technical courses were rated also as the second most important with 39.3%. Professional courses came in third with 28.6%, lab courses second least important (28.6%) and science courses rated the least important (50%).

Summary and Conclusions

The analysis of the survey results indicated that sophomore, junior, and senior engineering students hold the same perceptions regarding the benefits the course curriculum will have on their future career. However, the results show that students assign a higher perception of benefit to math courses, major specific technical courses, laboratory courses with hands-on components, and professional development courses. It is interesting to see the response to Q7 was just above neutral regarding the value of taking science courses in the engineering curriculum. In addition, it is remarkable to see that seniors ranked math equally as important as technical courses while juniors ranked math courses as 3rd most important out of 5. However, sophomores placed math only as the 4th. This possibly shows that students realize the importance of knowing math in their later years of study. Furthermore, all students, regardless of the year of study, ranked science courses as the least important.

It is vital that students perceive their undergraduate educational experience as one that successfully promotes their professional development. Graduates entering the engineering profession must be prepared to grapple with more complex issues than ever before. Our data demonstrates that the student's perception of the current curriculum to be generally positive.

Our findings suggest some important implications for the current curriculum by substantiating the positive student perception of math courses, major specific technical courses, laboratory courses with hands-on components, and professional development courses. The curriculum should be further reviewed to assess the lower student perceptions of the value of curriculum science courses.

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