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Statistical Analysis of the Perceptions of Industrial Engineering Students in Industrial Engineering Course

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Highlights

- Determining the Perceptions of Industrial Engineering students on their course through the use of statistical analysis such as Kruskal-Wallis and Mann-Whitney U Test.

Abstract

Industrial Engineering is a profession that focuses on systems improvements, efficiency, and maximum utilization of limited resources in order to increase profits and other benefits. This study aims to evaluate the perception of Industrial Engineering (IE) students of a University in Quezon City using statistical analysis such as Kruskal- Wallis and Mann - Whitney U Test in order to come up with departmental initiatives that will help students appreciate their pursued course. The researchers utilized the survey questionairre by Specking, et.al. (2015) and data were gathered from 271 IE students on various year levels . This reveals that 2nd year Industrial Engineering students has less appreciation towards Industrial Engineering specifically IE as a people oriented profession (p-value = 0.000), IE is about efficiency (p-value = 0.0151), and IE as a status potential (p-value = 0.034) which are less than the significance level of 0.05. In addition , second year students perceive IE as an easy engineering course with p – value = 0.000. This kind of analysis will be a great help for the university to implement specific academic activities in order to uplift their perception towards Industrial Engineering course.

Key Words: Industrial Engineering; Kruskal-Wallis, Mann-Whitney U Test

Introduction

Engineering is one of the most important fields of study in society. Numerous things would not be possibly made and used without it. It helps us to transform theoretical calculations and concepts into tangible products or create an efficient system for the betterment of the people. One of the oldest engineering disciplines existed during the Industrial Revolution is Industrial Engineering, which focuses on discovering the creation of things and improving systems efficiently and safely.

Perception plays a vital role in most researches since it refers to the act of apprehending and recognizing things. Numerous study papers regarding the determination of students' perception of their various expertise existed. Given this matter, there are only a few numbers of studies conducted on determining the perception of Industrial Engineering students on their respective course. Since Industrial Engineering is one of the oldest and broadest engineering disciplines, it is necessary to gather, and to fully understand the perception of the students' on the course they have taken.

Hence, several studies identified the perception and misconception of Industrial Engineering students at Oklahoma University (OU). This research is a longitudinal study with a three-phase with six stages to determine an engineering perception. The paper provides insights on determining the reason why do students are interested in Industrial Engineering field. The result emphasized the perception of IE students in the first phase, stage one only. They compare the perception and misconception of Engineering students, Faculty and Engineering Alumni, and industry partners and showed that the students do not fully understand Industrial Engineering and both Alumni, students, and faculty believe that the job opportunities in IE after 5 years will be good (Specking, Patricia, & Yang, n.d.).

In addition to this, a study performed by (Trytten et al., 2004), determine the perception of the students during their sophomore and junior years since they are more equipped and ready in taking up their major and they can still refresh their early experiences which may help them on creating decisions. The researchers conducted semi-structured interviews and emphasize analyzing the issues related to the gender pattern of Industrial Engineering students. The students were asked to describe their experiences in Industrial Engineering. Results showed that there are perception differences in terms of gender. Thus, the perception of the students was developed during their earlier studies in STEM Education.

Because of the limited number of researches conducted regarding Industrial Engineering field, this become a call to conduct a study to determine the perception of Industrial Engineering students to their course through the help of statistical analysis such as Kruskal-Wallis and Mann-Whitney U Test and will end up providing specific recommendations that will help the Engineering department of the University in deciding on how would they provide a better understanding to the students of the importance and roles of Industrial Engineering in the society.

Methods

This research used descriptive method to gather quantifiable information that can be used for statistical inference from the target audience.The study employed survey questionnaire and disseminate it to a sample size of 271 Industrial Engineering students from 1st year to 4th year level who are currently enrolled in a university. Quota sampling technique was used wherein the respondents were sampled using quota process which representative individuals were chosen out of the sub groups. During the data gathering, a 5 point likert scale survey questionnaire was distributed and the respondents' confidentiality was also considered. The collected data was analyzed using the frequency and percentage distribution, weighted mean, a non-parametric test called kruskal wallis test was used since the data set is not normally distributed and Mann-Whitney U-Test for post-hoc analysis.

Results and Discussion

Before conducting test to analyze the significant differences of the perception of IE students when grouped according to profile, the researchers will first check the normality assumption through Anderson-Darling Test. The results are as follows:

Table 1. Anderson Darling Test Results

Profile of the Respondents	Category	Anderson-Darling Value	P-value	Interpretation
Gender	Male	0.891	0.022	Not Normal
	Female	0.412	0.334	Normal
Year-level	1st	0.761	0.046	Not Normal
	2nd	0.490	0.217	Normal
	3rd	0.345	0.461	Normal
	4th	0.611	0.106	Normal
Is IE your first choice?	Yes	0.595	0.118	Normal
	No	0.844	0.029	Not Normal

Table 1 shows the Anderson – Darling Test results of the profile of the respondents. Gender profile has male which is not normally distributed (p-value = 0.022) and female which is normally distributed (p-value = 0.334). Year level profile has first year which is not normally distributed (p-value = 0.046), second year is normally distributed (p-value = 0.217), third year is normally distributed (p-value = 0.416), and fourth year is also normally distributed (p-value = 0.106). Respondents who responded yes is normally distributed (p-value = 0.118) and no is not normally distributed (p-value = 0.029). Since each of

the profile has variables that is not normally distributed, the researchers will use Kruskal-Wallis Test (this test do not assume normality on the data) to determine significant differences among groups on each of the profile. Aside from this, Kruskal-Wallis test the differences of medians among groups (Sawilowsky, et.al., 2014) and that is the main reason the researchers will describe the following responses using median.

Table 1. Median and Interpretation of Question 1,2,3 and 4 when grouped according to Gender, Year-level and their preference.

Questions		Do you perceive or expect that Industrial Engineering as people oriented?		Do you perceive or expect Industrial Engineering as efficient?		Do you perceive or expect that Industrial Engineering as business?		Do you perceive or expect that Industrial Engineering as broad discipline?	
Class	Category	x̃	Interpretation	x̃	Interpretation	x̃	Interpretation	x̃	Interpretation
Gender	Male	5	SA	4	A	4	A	4	SA
	Female	5	SA	5	SA	4	A	5	A
Year-level	1st	5	SA	5	SA	4	A	5	SA
	2nd	4	A	4	A	4	A	4	A
	3rd	4	A	4	A	4	A	4	A
	4th	5	SA	5	SA	4	A	5	SA
Is IE your first choice?	Yes	5	SA	5	SA	4	A	5	SA
	No	4	A	5	SA	4	A	5	SA

Legend: x̃: Median, SA: Strongly Agree,and A: Agree

Table 1 shows the perception of students in Industrial Engineering on questions 1, 2 , 3 and 4 when grouped according to gender, year-level and their preference. Their perception in Industrial Engineering as people oriented shows that both male and female, 1st and 4th year responded strongly agree. Students who find IE as their first choice strongly agrees that they see IE as people oriented.

In terms of their perception in Industrial Engineering as efficient shows that Female strongly agrees compared to male and 1st and 4th year students also responded strongly agree. Students who find IE as their first choice strongly agrees that they see IE as efficient. Same result was obtained for those students who did not consider IE as their first choice.

In terms of their perception in Industrial Engineering as business shows that all of the responses on gender and year-level are agree. Thus, students who find IE as their first choice agrees that they see IE as business. Same result was obtained for those students who did not consider IE as their first choice.

Lastly, in terms of their perception in Industrial Engineering as broad discipline shows that male strongly agrees compared to female respondents, 1st and 4th year also responded strongly agree. Students who find IE as their first choice strongly agrees that they see IE as broad discipline. Same result was obtained for those students who did not consider IE as their first choice.

Table 2. Median and Interpretation of Question 5,6,7 and 8 when grouped according to Gender, Year-level and their preference.

Questions		Do you perceive or expect that Industrial Engineering with problem-solving skills?		Do you perceive or expect that Industrial Engineering as communicators?		Do you perceive or expect that Industrial engineering as systems-oriented?		Do you perceive or expect that Industrial Engineering as a status potential?	
Class	Category	x̃	Interpretation	x̃	Interpretation	x̃	Interpretation	x̃	Interpretation
Gender	Male	4	A	4	A	5	SA	4	A
	Female	4	A	4	A	5	SA	5	SA
Year-level	1st	5	SA	5	SA	5	SA	5	SA
	2nd	4	A	4	A	5	SA	4	A
	3rd	4	A	4	A	5	SA	5	SA
	4th	4	A	4	A	5	SA	5	SA
Is IE your first choice?	Yes	4	A	4	A	5	SA	5	SA
	No	4	A	4	A	5	SA	4	A

Legend: x̃: Median, SA: Strongly Agree,and A: Agree

Table 2 above shows the perception of students in Industrial Engineering on questions 5, 6 , 7 and 8 when grouped according to gender, year-level and their preference. Their perception in Industrial Engineering with problem-solving skills shows that both male and female agrees, Out of the 4 year levels, 1st year students responded strongly agree. Students who find IE as their first choice agrees that they expect IE with problem-solving skills. Same result was obtained for those students who did not consider IE as their first choice.

In terms of their perception in Industrial Engineering as communicator shows that both male and female agrees and out of the 4 year levels, 1st year students responded strongly agree. Students who find IE as their first choice agrees that they see IE as communicators. Same result was obtained for those students who did not consider IE as their first choice.

In terms of their perception in Industrial Engineering as system-oriented shows that all of the responses on gender and year-level are strongly agree. Thus, Students who find IE as their first choice strongly agrees that they see IE as system oriented. Same result was obtained for those students who did not consider IE as their first choice.

Lastly, in terms of their perception in Industrial Engineering as a status potential shows that female strongly agrees compared to male respondents,while 1st, 3rd and 4th year students also responded strongly agree. Students who find IE as their first choice strongly agrees that they see IE as status potential.

Table 3 below shows the perception of students in Industrial Engineering on questions 9, 10 and 11 when grouped according to gender, year-level and their preference. Their perception in Industrial Engineering as invisible course shows that both male and female agrees, Out of the 4 year levels, 1st year students were undecided. Students who find IE as their first choice agrees that they expect IE with problem-solving skills. Same result was obtained for those students who did not consider IE as their first choice.

In terms of their perception in Industrial Engineering as an easy engineering discipline shows that the female students agrees and in contrary male respondents disagreed. Out of the 4 year levels, 1st, 3rd and 4th year level students responded agree. Students who find IE as their first choice disagrees that they see IE as engineering discipline.

Lastly, in terms of their perception in Industrial Engineering as an imaginary engineering shows that female disagrees compared to male respondents, 1st and 3rd year students disagrees. Students who find

IE as their first choice are undecided on seeing IE as an imaginary engineering. Same result was obtained for those students who did not consider IE as their first choice.

Table 3. Median and Interpretation of Question 9,10 and 11 when grouped according to Gender, Year-level and their preference.

Questions		Do you perceive or expect that Industrial Engineering as invisible course?		Do you perceive or expect that Industrial Engineering an easy engineering discipline?		Do you perceive or expect that Industrial Engineering an imaginary engineering?	
Class	Category	$\tilde{x}$	Interpretation	$\tilde{x}$	Interpretation	$\tilde{x}$	Interpretation
Gender	Male	4	Agree	2	Disagree	3	Undecided
	Female	4	Agree	2	Agree	2	Disagree
Year-level	1st	3	Undecided	2	Disagree	2	Disagree
	2nd	4	Agree	4	Agree	3	Undecided
	3rd	4	Agree	2	Disagree	2	Disagree
	4th	4	Agree	2	Disagree	3	Undecided
Is IE is your first choice?	Yes	4	Agree	2	Disagree	3	Undecided
	No	4	Agree	3	Undecided	3	Undecided

Table 4 below shows that year levels of IE students has significant difference on their response on IE is a people oriented profession. According to Mann-Whitney U Test, first year vs. second year responses and first year vs third year responses has significant difference at p-value = 0.000 and 0.0036 respectively. Thus first year students strongly agree that IE is a people oriented profession as compare to second year and third year students' perception.

The perception on IE is about efficiency reveals that gender and year level has significant difference on their responses. Female strongly agrees that IE is about efficiency as compare to male IE students. According to Mann-Whitney U Test, first year vs second year, first year vs third year, and third year vs fourth year shows significant difference on responses with p-value 0.0151, 0.0104, and 0.0438 respectively thus it can be concluded that first year strongly agrees that IE is about efficiency as compare to second year and third year while fourth year has the same response to first year as compare to third year.

The perception of IE students strongly agrees on IE is a broad engineering discipline except female students just responses agree.

IE students also strongly agrees that IE is a status potential except the year level that shows significant difference. According to Mann-Whitney U Test, first year vs. second year responses has p-value = 0.0034 which is significant. Thus first year students strongly agree that IE is a profession with status potential as compare to second year.

The responses of IE students on the perception of IE as an easy engineering course is disagree except for the second year level students agrees as compare to first year with p-value = 0.000 and first and fourth year students with p-value = 0.0098 which are all less than the significance level of 0.05.

Lastly, IE students categorized to gender has significant difference because female disagrees that IE is an imaginary engineering as compare male IE respondents.

Table 4. Kruskal-Wallis results of the perception of Industrial Engineering students.

Question	Industrial engineering as people-oriented		Industrial engineering as efficiency		Industrial engineering as business related	
Category	P-value	Interpretation	P-value	Interpretation	P-value	Interpretation
Gender	0.224	Not significant	0.033	Significant	0.513	Not significant
Year level	0.011	Significant	0.017	Significant	0.141	Not significant
Preference	0.07	Not significant	0.0774	Not significant	0.208	Not significant
Question	Industrial engineering as broad discipline		Industrial engineering as problem solving		Industrial engineering as good communication	
Category	P-value	Interpretation	P-value	Interpretation	P-value	Interpretation
Gender	0.032	Significant	0.335	Not significant	0.516	Not significant
Year level	0.101	Not significant	0.218	Not significant	0.218	Not significant
Preference	0.274	Not significant	0.313	Not significant	0.998	Not significant
Question	Industrial engineering as systems oriented		Industrial engineering as status potential		Industrial engineering as invisible course	
Category	P-value	Interpretation	P-value	Interpretation	P-value	Interpretation
Gender	0.042	Significant	0.265	Not significant	0.809	Not significant
Year level	0.51	Not significant	0.041	Significant	0.058	Not significant
Preference	0.431	Not significant	0.18	Not significant	0.214	Not significant
Question	Industrial engineering as easy engineering course		Industrial engineering as imaginary engineering			
Category	P-value	Interpretation	P-value	Interpretation		
Gender	0.26	Not significant	0.038	Significant		
Year level	0	Significant	0.285	Not significant		
Preference	0.146	Not significant	0.352	Not significant		

Conclusions

Based on the findings, it is obviously noticed that 2nd year Industrial Engineering students has less appreciation towards Industrial Engineering specifically IE as a people oriented profession, IE is about efficiency and IE as a status potential. Aside from it, second year students also perceive that Industrial Engineering is an easy engineering profession. Hence , since the second year students has different perception compared to other year- levels, the researchers recommend to conduct a thorough qualifying examination for the incoming freshman students, since 2nd year level that time do not undergone qualifying assessment before enrolling on IE course compare to 1st year students. Thus, the qualifying exam will help them to decide if they want to pursue their career as an Industrial Engineer in the future. In addition, the University must pursue on conducting a regular IE Orientation for the upcoming IE students to help them to understand the roles and responsibilities of an Industrial Engineer in the corporate world. It is also recommended that the students must participate in any IE related trainings,seminars and workshops that will awaken their full understanding on the significance of Industrial Engineering on various industries and in the society. Lastly, Future researchers can use this study as a reference to find other factors that might affect the perception of students on their preferred courses.

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