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Determining The Factors Affecting The Quality Of Engineering Education

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Abstract

This study aims to measure factors affecting the quality of engineering education with a case study conducted in one of the Turkish Universities. The problem statement is about finding out whether or not the quality systems and information quality affecting engineering education at the university. The study highlighted the relationship between the quality system and the actual use of engineering education. The research methodology is based on a qualitative research approach to measuring the Quality of Engineering Education. The results showed that there is a positive relationship between information quality and the actual use of Engineering Education. Moreover, the system quality has a positive effect on actual use.

Keywords: Quality system, Quality information, Engineering Education

Introduction

Recent decades have seen the introduction of numerous new services, technologies, and applications by governments, businesses, and society that have both direct and indirect effects on the lives of consumers. As a result, it is believed that businesses started paying more attention to after-sales and started enhancing customers long after they had purchased the goods or services. It is getting harder and harder to maintain customer satisfaction levels, and it takes specialized knowledge to handle these problems on regional, domestic, and international scales (Murali et al., 2016). In a cutthroat market, firms' success is said to be dependent on their ability to satisfy their customers. What steps can a business take to ensure that its clients continue to be satisfied? The fulfillment of both explicit and implied needs, along with the customers, is what determines satisfaction. In a cutthroat market, firms are thought to succeed or fail on how satisfied their customers are. How can a business ensure that its customers continue to be satisfied? Customer satisfaction is influenced by several qualities or service aspects, including the fulfillment of both explicit and implicit criteria. Finding out is crucial since customer happiness is correlated with how well the various traits function (Tontini & Sant'Ana, 2008). The evaluation of procedures or processes thus offers itself as a great instrument for identifying the issues and locating the root causes, while it may also enable the formulation of corrective or alternative actions to increase the efficacy and efficiency of these transformations. It is noted that the measurement process for evaluation involves a certain good or service, both the performance evaluation and the measurement of customer satisfaction (Murali et al., 2016). The research in question will focus on the service industry, particularly higher education provided by private institutions of learning. The process of identifying and understanding the causes of project successes and failures, both in terms of individual difficulties as well as those linked to teams or divisions, is greatly aided by the review of institutional management, which provides information needed to do so (regionals, domestic and global). The data gathered during the evaluation of a school can be used to refocus decision-making and help with the creation and revision of strategic planning. According to Bernroider & Schmöllerl (2013), it is crucial to have access to knowledge about the market, the environment, and the company's macroenvironment in order to reduce risk when making decisions on the management of an organization.

Problem Statement

This study takes into account the decision-making process to evaluate institutional management and integrates statistical methods like structural equation modeling with the assessment process of students' being happy with the course they are taking, designing a measurement scale that has items for measuring satisfaction. Factorial and regression analysis are combined in Structural Equation Modeling (SEM). Applications of SEM can specify a structural model and estimate a few interdependent

multiple regressions simultaneously (Iacobucci, 2010). Furthermore, a comprehensive and complete analysis of the system is performed. However, because the calculations are so difficult and a sizable sample is necessary to assess the determinants involved, structural equation modeling hasn't been widely used in research (Tinoco & Ribeiro, 2007). Education institutions must evaluate the measure used to gauge student satisfaction with the course since it offers a window into the methods used in instruction and information on how to raise the standard of instruction for courses the institution offers (Lidice & Saglam, 2013).

1.3 Research Questions

1. What are the effects of system quality on Actual use?
2. What are the effects of Information Quality on Actual use?

1.4 Research Objectives

1. To determine the effects of system quality on Actual use
2. To discover the effects of Information Quality on Actual use

1.5 Research Hypothesis

Hypothesis 1. System quality has a significant direct effect on perceived ease of use.
Hypothesis 2. Information quality has a significant direct effect on perceived usefulness.

Theoretical Framework
Quality management in education

It is clear that paradigms within the nation's educational system need to alter as a result of the numerous changes that are currently occurring in people's everyday lives. It should be stressed that these adjustments are necessary to embrace participatory,
activities that are democratic and participative. These are typically characterized by dynamic and worldwide movements that are utilized to build alliances, networks, and partnerships in search of challenges to solve and to grow, as well as to foster interaction between directors, employees, customers, and/or users. One observation made throughout this transformation is that not only educational institutions but even the firm itself urge that this change be implemented. When trying to impose the term "quality" as a fad, it was used carelessly and lost its meaning. The adoption of quality as a component of a management system by an organization brings about significant benefits, values, and favorable outcomes. Many academics have argued that it is everyone's responsibility to "do things right the first time," but they have neglected to consider that not all organizational structures will react the same way to the application of this principle, as is the case with the large area that involves the educational process. The body of research demonstrates that studies, analyses, and research have concluded that the quality of education is a highly complex phenomenon with multiple dimensions that cannot be understood solely by acknowledging the variety and quantity of the components involved in this process. If curriculum programs and study plans adhere to the predetermined standards, education is of high quality; it also introduces content that is given due importance and relevance. If education lives up to parents' and students' expectations; if educated students actively participate in efforts to address community needs when working together to solve problems; and, finally, if the student can use the knowledge they have gained to raise their standard of living and contribute to the improvement of their neighbors and the environment in which they live.

Factors associated with technology utilization and adoption in education

Technology performance is a complex process that depends on its uniqueness as well as relationships between human resources and educational environments. The following elements are noted as having an impact on educational technology use.

The role of the Teacher

The teacher is connected to a set of factors that are frequently highlighted as influencing how technology is used in education. The primary element linked to the use of technology by instructors has been noted time and time again. If not, a teacher will cling to positive ideas about technology and will not be required to use it in the classroom. Another aspect that seems to encourage the proper use of technology in education is the instructive attitudes and instructional practices of teachers.

E-learning

Online learning, distant learning, and e-learning are all various terms for the same thing. The definition of E-learning given by the authors is "the broad range of applications and procedures which leverage accessible electronic media and capabilities to deliver vocational education and training." The use of various web-based, web-distributed, or web-capable technical instruments for education is described by researchers as "e-learning." Due to its many benefits, including adaptability, internet accessibility, and affordability, e-learning has been expanding every

year. These benefits might change schooling into a process of lifelong learning. Students are better able to remember the knowledge needed for traditional education when they have access to lectures whenever they need to, as many times as necessary. People's obligations to their families or jobs can be accommodated by E-flexibility, learning's which could lead to a growth in the number of students pursuing this course of study. This extends beyond the students and provides flexibility for the teachers as well. Additionally, educational institutions are integrating E-learning technology to build the learning community and enhance communication between students and teachers for better knowledge exchange as well as to achieve individual goals. The National Center of E-learning and Distance Learning (NCEDL), which at least nine universities were a part of, was founded by the Kingdom of Saudi Arabia in 2005. By adopting and implementing the most efficient E-learning system techniques, this key position sought to improve the E-learning experience in educational institutions globally. The National Center of E-learning and Distance Learning (NCEDL) reports that the NCEDL has been involved in a number of E-learning system projects, such as the Learning Portal, which enables students to access online course materials from anywhere and instructs teachers on how to use E-learning tools. In order to encourage educational institutions to use E-learning, the center also developed the Award for Excellence in E-Learning, which currently includes 42 institutions. The Saudi Electronic University (SEU), founded by the Saudi government in 2011, has tens of thousands of students enrolled in its many programs. Including graduate and undergraduate programs. Since these incidents, King Abdulaziz University has introduced a variety of technological tools to improve its use of the online learning environment. One such tool is the Learning Management System (LMS), which helps new and junior students by giving them access to more than 16,000 e-books as well as other academic resources online. During the COVID-19 epidemic, when education changed from on-campus to distance learning quickly and without adequate time to organize, all these E-learning endeavors had an influence. Critical Realism, a theoretical stance that seeks to generate more in-depth levels of explanation and understanding, serves as the inspiration for our examination of engineering ethics education (McEvoy & Richards, 2006). Accident causation is an illustration that relates to engineering ethics. Pearce and Tombs (1998) argue that the analysis of accident causation frequently focuses on first-order causes, such as immediate production pressures, poor communication, or lack of training, and less on the second-order underlying mechanisms that generate them. They make this claim by explicitly drawing on critical realism. Before examining their causes, which are frequently social, political, or historical, explanations of accidents should contextualize their occurrence within "prevailing systems of economic, social, and political organization, dominant value systems and beliefs, and the differential distribution of power" (Dien et al., 2012). Our strategy responds to arguments for viewing education as a complex, multi-layered system by taking inspiration from critical realism. The frameworks of paradigm and purpose influencing policy and practice in higher education are largely hidden from view and, as a result, from debate, according to Sterling (2004), who employs the image of an iceberg to make this point. Godfrey (2009) emphasizes the necessity of locating research results pertaining to individual beliefs and practices visible in engineering education inside more substantial systems. Lattuca and Stark (2011) make a similar argument in support of using a depth analysis, claiming that the higher education curriculum reflects its sociocultural milieu. Nevertheless, the sociocultural environment that influences people's behaviors has received less attention in higher education studies. Our written work has four layers of analysis that make up the survey, and their key characteristics and relationships are examined. These four levels are I the individual level, which is represented by teachers and students, (ii) the institutional level, which is represented by institutions of higher learning like engineering departments, programs, or colleges, (iii) the policy level, which is represented by national accrediting bodies, and (iv) the broader cultural context in which engineering education is practiced. A multi-level approach enables us to address some of the shortcomings of research in higher education, which frequently consists of either focusing on the policy and practice levels without looking at the deeper levels of paradigm and purpose guiding them or only including individual agents, such as instructors or students (Sterling, 2004). Our contribution aims to situate people in their sociocultural, institutional, and policy contexts and connect some research findings in engineering ethics education with broader discussions about the preeminent paradigm for engineering education by using an approach that focuses on different analytical levels (Jamison et al., 2014). Clarity regarding the goals of engineering education and reform programs is a crucial issue that arises. The ultimate goal is to establish a socio-technical orientation of the engineering curriculum for ethics and to lay the foundation for thinking on the structural techniques required for bringing about change in engineering ethics education. The Web of Science's core collection was used in the literature review to locate studies on undergraduate engineering ethics instruction. A review of the references cited by the

most cited articles was conducted after the process of gathering sources based on keyword searches in order to find other publications pertinent to the analysis's goals that do not include this combination of key terms in their title or abstract. The journals and conference proceedings that had the greatest number of articles during the initial search were then subjected to the second round of searching. To find additional publications with the word "ethics" in their title, abstract, or keywords, the first author specifically searched the databases of the Journal of Engineering Education, the European Journal of Engineering Education, and Science and Engineering Ethics, as well as the conference websites for the American Society for Engineering Education and the European Society for Engineering Education. The extensive research published in English and the overemphasis on research done in the US, UK, Australian, and Western European contexts, to the exclusion of potentially relevant studies set in other national and cultural contexts, are two limitations that came to light during the source retrieval process. The accuracy with which the published research on engineering ethics education, which serves as the foundation for our analysis, reflects actual teaching and institutional attitudes and practices, is a second limitation. The studies that have been published can be taken into account as a trustworthy indicator of the difficulties and current conditions in engineering ethics education, even though it is impossible to guarantee that the entirety of teaching and institutional attitudes and practices is represented by the existing research. The examination of policy actors was restricted to accrediting organizations, leaving out other significant actors like funding organizations or state ministries. This represents a final constraint. Being modest about the depth we can ensure in a journal publication while also being aware of the role played by this policy body in engineering education across the globe, we are merely referring to accrediting bodies in this context. We believe that while other policy players may be limited to playing a role in certain geographical circumstances, accreditation is a force influencing engineering education in numerous and varied national contexts. It is unclear how to establish curricular congruence because there is little data on the frequency of each learning objective in engineering ethics instruction or on the teaching strategies and materials to achieve them. Additionally, little is known about the ways in which learning objectives might help students grasp the societal mission of engineering, as reflected by the more general theoretical frameworks used to construct engineering ethics education. Learning objectives can be further classified under micro ethics, macro ethics, virtue ethics, value-sensitive design, and feminist ethics of technology when taking into account the more well-known theoretical frameworks created in recent decades. The micro-ethical paradigm places a lot of focus on engineers' individual accountability. Micro ethics, according to Basart and Serra (2013), "is usually centered on engineers' ethics, engineers acting as individuals." With a focus on developing students' professional responsibility through an understanding of professional codes and honing their moral sense, it aims to expose students to ethical challenges. This is the theoretical framework that is thought to dominate engineering ethics instruction (Colby & Sullivan, 2008). The macro ethics approach engages the engineering profession as a whole and considers the profession's obligations beyond comprehending engineering acts and responsibilities in terms of individuals. The emphasis is on societal technology decision-making and the collaborative duties of engineers. For an engineering agency to act morally, goals address the environment of engineering practice (Chance et al., 2021). Macroethical objectives may also include fostering active participation in public policymaking to create laws and regulations that support socially just behaviors or supporting the development of technologies that are compatible with democratic and egalitarian institutions and structures. Goals that highlight the value of context sensitivity, the learning of moral virtues, and the development of practical judgment (phronesis) for dealing with real-world situations are representative virtue ethics methods. Developing the moral attitudes or virtues of the deciding agents that would influence an engineer's activities is the main goal of virtue ethics, not determining whether engineering decisions, acts, or outcomes are morally justifiable. According to virtue ethics, teaching the future engineer how to develop particular character characteristics or virtues must be combined with educational strategies that emphasize moral conduct and its effects. It has been suggested that virtue ethics is a more suitable framework for describing engineering professionalism's sensitivity to risk, understanding of the social context of technology, respect for nature, and dedication to the common good. Engineering students' ethical competence is also thought to be improved by virtue-based teaching techniques, which support learning objectives aimed at enhancing ethical sensitivity, awareness, analysis, and judgment. According to Bowen (2009), the goal of engineering is to improve either the quality of human life, the well-being of the community, or the health of the ecosystem. This theoretical perspective serves as the foundation for this claim. Fostering a virtue-based approach in engineering education can help students develop their professional identities as "virtuous engineers," who can claim responsibility for engaging in a combined human performance that involves the use of practical judgment to improve

the material well-being of all people by achieving safety, sustainability, and efficiency while displaying objectivity, care, and honesty in assessing, managing, and communicating risks.

Research Framework

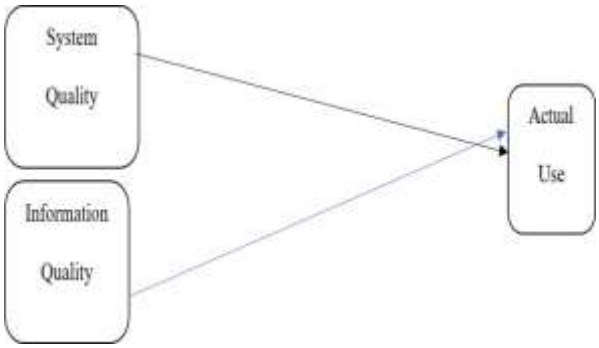

Figure 1. Theoretical Framework

The table reveals the summary of demographic data. The contributors of males and females. Table 1 reveals that the indicators of males are more than females. The table shows that the indicators of females are slightly decreased than males. It refers to the gender of contributors who study at the university. The male is 199 (52.8%) and the female is 178 (47.2%). The table reveals the sample distribution by age. The highest indicator is the rank 41-50. It records 43.5% (164). However, the second age of the contributors is 31-40. It recorded
34.2 (129). In addition, the age over 50 has been a record 15.4% (58). The lowest indicators are from 20-30. It records 6.9% (26). It also reveals the age of most employees in the university. The table reveals the educational level of the contributors. The result shows that 97.3 % have a bachelor degree. However, 7.2% of the contributors have master degree. In addition, the diploma has been recording 5.3 %. PHD indicator has been recording 0.3%.

Code	Items	Mean	Std. Deviation
SYS1	I find the online meeting platform easy to use	4.23	0.718
SYS2	I find it flexible to communicate with the online meeting platforms.	4.23	0.709
SYS3	I feel comfortable using the online meeting platform services and functionalities	4.23	0.635
SYS4	I have a clear and understandable interaction with online meeting platforms.	4.12	0.696

This result shows that the main requirement for working in the banking sector is bachelor degree. Moreover, table shows the highest frequency is bachelor degree (329). However, the lowest frequency is PHD (1). Moreover, the master degree has been record (27). In the last, Diploma also has been record (20). The table 1 reveals the nature of work or the nature of the department inside the university.

Summary of Frequency Table for Demographic Profile

Category	Frequency	Percentage (%)
Gender		
Male	199	52.8
Female	178	47.2
Age		
20-30	26	6.9
31-40	129	34.2
41-50	164	43.5
Over 50	58	15.4
Education Level		
Diploma	20	5.3
Bachelor degree	329	87.3
Master	27	7.2
PHD	1	0.3

Descriptive Statistics

The questionnaire of this study is divided into nine variables. The data has been collected from 30 students from the university relying on some significant indicators. Each variable refers to two or three significant indicators. Consequently, the statistical results of this variable will be linked with this indicator within the explanation. The first variable for the respondents' demographic profiles is divided into five questions (gender, age education level, work experience, and nature of work). The second variable system quality, The variable contains 4 items. The first three items have the same result, they achieved 4.23. However, the last item is 4.12.

System Quality (SYS Variable)

The table explains the system quality (SYS) variable. The variable contains 4 items. According to the Lickert scale, the total mean is significant if the variable achieves 3 and above the first rank for the sentence that states (Online meeting platforms deliver useful information to my needs.). The mean of the first ranking in this variable is 3.97. The second-ranking of this variable to the sentence states (Online meeting platforms offer exactly the knowledge I need). The mean of the second-ranking is 3.95. The third ranking in this variable is the sentence that states (IT improves transactions). The mean of the third-ranking in this variable is
3.85. The fourth ranking of this variable in the sentence states (IT improves transactions).

The last sentence takes the last ranking in the innovations technologies variable which sentence (To save or withdraw money is time consuming). The mean of the last sentence in the innovations technologies variable is 3.33.

Information (IQ) variable

Code	Statement	Mean	Std. Deviation
IQ1	Online meeting platforms deliver useful information to my needs.	3.97	0.893
IQ2	Online meeting platforms offer exactly the knowledge I need.	3.95	0.779
IQ3	Online meeting platforms provide me knowledge and organized content.	3.85	0.814
IQ4	Online meeting platforms provide up-to-date information and content	3.33	0.899

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Quality system, information Technology	-	Enter

a. Dependent Variable: Actual Use
b. All requested variables were entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.787[a]	.619	.608	.53285

a. Predictors: (Constant), Actual Use

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	25.946	4	6.486	16.856	.000[b]
	Residual	25.013	65	.385		
	Total	50.959	69			

a. Dependent Variable: Actual Use
b. Predictors: (Constant), Quality system, information Quality

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.750	.449		1.671	.100
Quality System	.459	.098	.468	4.672	.000
Information Quality	.212	.100	.012	1.119	.000

a. Dependent Variable: Actual Use

Findings

There is a statistics positive relationship between quality system in actual use. There is a statistics of information quality. The result also shows that the statement that express the axis is I find the online meeting platform easy to use, flexible to communicate with the online meeting platforms and feel comfortable using the online meeting platform services and functionalities.

Recommendations

1. Obtaining a regression model that can lead to enormous investments and increase the actual use.
2. Providing a strategic plan that makes synergy between the investments of different universities in order to increase the quality system of education. Undoubtedly, this approach leads to economic growth.
3. Developing a model to increase the creative relationship between students and universities.

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