

Ethical Perceptions of Engineering Faculty Students

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Abstract—The aim of this study is to evaluate the professional ethical perception levels of engineering faculty students. The research was carried out with 125 students studying in engineering faculties of various universities in Kazakhstan. In this study, a quantitative research method was adopted, which takes the numerical data as a reference for itself while making associations about the findings and creates the opportunity to evaluate statistical analyses while doing this, while at the same time revealing the similarities and differences in the sample. In the research, a behaviour list consisting of 16 items was used to evaluate the ethical perceptions of engineering faculty students. Frequency (f) and percentage calculations from statistical techniques were used in the analysis of quantitative data. As a result of the research, it has been determined that there is a difference between students' ethical perceptions about themselves and their colleagues. While the students evaluated the behaviours in the behaviour list from their own perspective, they found it less unethical and also found the behaviours they evaluated in terms of their colleagues more unethical. In this direction, the necessity of reorganising the course curricula with an ethical focus, in-service training of academic staff on ethical leadership, creating a corporate culture for universities to reinforce students' ethical behaviours and organising seminars to strengthen commitment to ethical values has emerged.

Keywords—ethics, professional ethics, agile perception, engineering faculty students

1 Introduction

In Changes in economic, social and technological aspects force educational institutions, children and young people to successfully transition from school to work and direct the demands of this transition process [1]. Factors such as economic changes in

businesses, technological advances and the environment in which businesses live increase the importance of ethical and business ethical concepts in businesses. Especially, in today's world of rapid change and uncertainty, the importance of business ethics is increasing for businesses. Although business ethics is important in itself for businesses, it is also important for society. University students are required to carry out studies and research related to their fields and also to have ethical elements [2].

1.1 Theoretical and conceptual framework

Ethics refers to systems of evaluation, action, behaviour or norms of behaviour that are sometimes valid in a particular group at a particular time; evaluations, actions and individuals are expected to determine their behaviour in their relationships with other individuals. These are common, lively, unwritten concepts about what is 'good' and 'bad' and what should or should not be done in general [3]. Neither meaning nor criticism can be expected in an area that has no ethical value [4].

Ethics is a concept related to the individual himself and is associated with the handling of moral problems. Ethics education includes examining and evaluating the moral consequences of reflective action choices among alternative behaviours that are unclear and contradictory [5]. Ethics is a branch of philosophy that investigates the nature and foundations of the values based on the relationship between people and morally examines good or bad and right or wrong [6].

Ethics is also concerned with describing and writing down moral requirements and behaviours that suggest acceptable and unacceptable behaviour patterns that serve as a function of philosophical principles [7]. According to another view, ethics is a discipline in which right and wrong, good and bad, virtue and vice are systematically examined [8]. Ethical decision-making is the process of making choices by systematically considering and evaluating various ways and/or consequences of a behaviour or activity according to ethical principles. In other words, ethical decision-making refers to a logical process that includes deciding on the morally right action with a systematic way of thinking in a situation where there are conflicting options [9].

Ethics is a requirement in every profession. Therefore, it should be taken into account in human employment and working environments. Due to the high impact of educational environments, and especially universities, on the future of students and their critical role in the delivery of education and the further development of societies, the importance of recognising and observing professional ethics in these environments has increased [10]. Although craft knowledge is a prerequisite for the formation of professional identity and qualifications, it is not sufficient. The common values, attitudes and principles of professional ethics that a member of the profession acquires are extremely decisive in the application and presentation of knowledge [11].

Professional ethics helps to determine one's own moral culture, professional characteristics and social responsibilities in the most appropriate way, regardless of the profession. In addition, members of a profession try to comply with professional ethics all over the world. Professional ethics is an application at the personal initiative of the members of the profession; the society, the environment and the vocational education

system of the members of the profession are also factors that play an important role in the value given to professional ethics [12].

Since engineering ethics is an important component of engineering field knowledge, it is recommended that educators involved should be among those who have knowledge of the engineering field [13].

The first ethical rules in the field of engineering in the world were implemented by the American Institute of Electrical Engineers (AIEE) in 1912. An Ethics Study Centre (CSEP) was established in 1976 at the Illinois Institute of Technology to study ethical values and rules in various professions. Today, there are 90 ethical rules in the CSEP library, created by 21 different associations from approximately 10 different countries. Basic engineering ethics has also been defined by the American National Association of Professional Engineers (NSPE) [14].

They are as follows:

- Engineers shall put the safety, health and welfare of the community first in the performance of their professional duties.
- Engineers should only provide services in their area of expertise.
- Engineers will only publish objective and true official reports.
- Engineers will act as reliable attorneys for any employer or client in professional matters and avoid conflicts of interest.
- Engineers will establish their professional reputation in the validity of their services and will not enter into unfair competition with others.
- Engineers will work to promote and develop their professional integrity, honour and value.

1.2 Related research

Hollander [15] describes the ongoing international activities to develop an international code of research ethics, as well as a wide variety of standards affecting engineering practices. These activities and efforts provide part of a global background for future engineering ethics education.

Cantwell et al. [16], in their work on engineering ethics, stated that beyond simple rights and individual wrong decisions, it covers the work that needs to be done together with the standards of behaviour expected from the actions of engineers in a professional work environment.

In his study, Cheruvalath [17] stated that ‘mandatory engineering ethics’ is a combination of curriculum integration models that can provide more frequent encounters with ethical evaluation and action opportunities, together with the course related to this content.

In their study, Gulmez et al. [18] compared students’ perspectives on ethical sensitivity according to their classes; they concluded that 3rd and 4th-year students studying at the undergraduate level are more sensitive than 1st and 2nd-year students.

In his study, Erdener [19] argues that there are few differences in the field of education and research focused on business ethics among Central Asian countries, including Kyrgyzstan and Kazakhstan, and that these activities are at a lesser institutionalised

level compared to Russia, which is the leader among the former Soviet countries. In this framework, it even suggests that appropriating and adapting solution models produced from fundamentally different cultures is not a useful approach to close the said gap. Instead, he emphasised the necessity of searching for appropriate solutions and approaches by conducting research based on current realities, historical and cultural backgrounds in Central Asia, taking them into account.

Panina [20] shows in her work the strengthening of the role of professional ethics in the regulation of professional activity in an innovative society, in connection with the increase in uncertainty and the unpredictability of social development. In the research, it was emphasised that moral competence has become a part of engineering professionalism. According to Panina [20], the moral education and training of engineers should be applied in an engineering ethics course in a technical university. Only in this way can the aims of the engineering ethics course and the ethical foundations of technical decision-making in modern society be formulated.

1.3 Purpose of the research

The aim of this study is to evaluate the professional ethics perception levels of engineering faculty students. The following questions, prepared in accordance with the purpose of the research, constitute the sub-objectives of the research:

1. What are the ethical perceptions of engineering faculty students regarding their own behaviour?
2. What are the ethical perceptions of engineering faculty students regarding the behaviour of their colleagues?

2 Method and materials

In this section, the model of the research, the study group, the method followed, the data collection tool, the application of the data collection tool and the analysis methods of the obtained data are emphasised.

2.1 Research method

In this study, a quantitative research method was adopted, which takes the numerical data as a reference for itself while making associations about the findings and creates the opportunity to evaluate statistical analyses while doing this, while at the same time revealing the similarities and differences in the sample. At the point of the analysis of the data, the quantitative analysis was handled within the framework of the categorical approach, and the descriptive analysis was included at the point of the evaluation of the obtained data. In quantitative research, the researcher can use questionnaires to collect standardised numerical data. Quantitative research is usually conducted in a more structured environment that allows the researcher to have control over the study variables, setting and research questions [21].

2.2 Participants

This research was conducted with 125 students studying in engineering faculties of various universities in Kazakhstan. Engineering faculty students participating in the research were selected from among the students who actively took courses in the 2020–2021 academic year. Demographic information about the students who voluntarily agreed to participate in the study is provided in Table 1.

Table 1. Demographic characteristics of students

Section	Gender		Sum
	Female	Male	
Computer Engineering	13	19	32
Mechanical Engineering	14	17	31
Biomedical Engineering	21	9	30
Chemical and Materials Engineering	17	15	32
Total	65	60	120

In Table 1, the demographic and gender distributions of the engineering faculty students participating in the research are provided. 32 Computer Engineering, 31 Mechanical Engineering, 30 Biomedical Engineering and 32 Chemical and Materials Engineering students participated in the research. Of the students participating in the study, 65 were girls and 60 were boys. A total of 125 students participated in the research.

2.3 Data collection tools

In the research, a behaviour list consisting of 16 items was used to evaluate the ethical perceptions of engineering faculty students. The behaviours in the questionnaire were taken from the study by Stappenbelt [22]. The behaviour list and scaling are given in Table 2. For each of the 16 behaviours, students evaluated both their own beliefs and their beliefs about their colleagues. Students were asked to rate how unethical they found each behaviour and how unethical their colleagues would find each behaviour.

Table 2. Behaviour list and scaling

No	Behaviour List	Totally unethical	Generally unethical	A little unethical	Not so unethical	Not unethical at all
1	Accepting gifts/help in exchange for preferential treatment.					
2	Taking on a job in an area you know little about.					
3	Placing the blame for error on an innocent colleague.					
4	Not supporting a colleague who is trying to do the right thing					
5	Giving a gift in exchange for preferential treatment					

No	Behaviour List	Totally unethical	Generally unethical	A little unethical	Not so unethical	Not unethical at all
6	Claiming profit from someone else's labour					
7	Not reporting that others are violating corporate policies					
8	Disclosure of confidential information					
9	Withholding relevant information from a colleague or client					
10	Submitting an excuse for sickness to take a day off					
11	Stealing institution materials					
12	Dealing with personal business during work time					
13	Not following the latest developments in your field					
14	Hide mistakes made					
15	Taking extra personal time (breaks, leaving work early)					
16	Using corporate services for personal benefit					

Scaling: 1 = Totally unethical, 2 = Unethical in general, 3 = Slightly unethical, 4 = Not very unethical, 5 = Not at all unethical.

While calculating the item intervals, the intervals were assumed to be equal and the score intervals for the arithmetic mean were calculated using the following formula: $\text{Score interval} = (\text{Highest value} - \text{Lowest value}) / 5$. The value ranges created based on this calculation are provided in Table 3.

Table 3. Item evaluation intervals

Item Rating Value	Value range
1. Totally unethical	1,00–1,80
2. Generally unethical	1,81–2,60
3. A little unethical	2,61–3,40
4. Not so unethical	3,41–4,20
5. Not unethical at all	4,21–5,00

While calculating the item intervals, the intervals were assumed to be equal and the score intervals for the arithmetic mean were found to be 0.80.

2.4 Data collection process

In the study, which will be carried out with engineering faculty students who voluntarily agreed to participate in the research, it was decided that face-to-face studies would not be suitable for health measures, considering the COVID-19 pandemic. In this direction, the behaviour list used as a data collection tool in the research was sent to the

engineering faculty students via email. A detailed information form covering the process of conducting the research was delivered to the participants. This form contains information about the purpose of the research, the ethical process and the confidentiality of the personal information of the participants. It took about 6 weeks for the research participants to complete the behaviour list and deliver it to the researchers.

2.5 Data collection analysis

Frequency (f) and percentage calculations from statistical techniques were used in the analysis of quantitative data. The behaviour list was delivered to 135 people in total. After the data cleaning processes, 15 of the behaviour lists were not included in the study due to sloppy filling. The answers of the engineering faculty students participating in the research regarding the behaviours in the behaviour list are evaluated in the results section.

3 Results

In this section, engineering faculty students' responses to the behaviours included in the questionnaire developed by Stappenbelt [22] were evaluated by themselves and their colleagues.

In Table 4, the ethical perceptions of engineering faculty students regarding their own behaviour are evaluated.

Table 4. Ethical perceptions of students regarding their own behaviour

No	Totally unethical		Generally unethical		A little unethical		Not so unethical		Not unethical at all		Total		
	F	%	F	%	F	%	F	%	F	%	F	%	Ort.
1	26	20,8	33	26,4	46	36,8	13	10,4	7	5,6	125	100	2,53
2	9	7,2	25	20	39	31,2	32	25,6	15	12	125	100	3,03
3	76	60,8	32	25,6	13	10,4	4	3,2	0	0	125	100	1,56
4	15	12	16	12,8	41	32,8	42	33,6	11	8,8	125	100	3,14
5	27	21,6	35	28	42	33,6	16	12,8	5	4	125	100	2,49
6	51	40,8	48	38,4	14	11,2	8	6,4	4	3,2	125	100	1,92
7	42	33,6	29	23,2	27	21,6	21	16,8	6	4,8	125	100	2,36
8	27	21,6	65	52	22	17,6	3	2,4	7	5,6	125	100	2,16
9	18	14,4	21	16,8	62	49,6	10	8	14	11,2	125	100	2,84
10	8	6,4	22	17,6	36	28,8	31	24,8	28	22,4	125	100	3,39
11	24	19,2	21	16,8	47	37,6	30	24	3	2,4	125	100	2,73
12	17	13,6	52	41,6	30	24	15	12	11	8,8	125	100	2,60
13	6	4,8	14	11,2	29	23,2	49	39,2	27	21,6	125	100	3,61
14	34	27,2	41	32,8	23	18,4	16	12,8	11	8,8	125	100	2,43
15	10	8	29	23,2	72	57,6	12	9,6	2	1,6	125	100	2,73
16	34	27,2	41	32,8	32	25,6	11	8,8	7	5,6	125	100	2,32

In Table 4, the ethical perceptions of the engineering faculty students participating in the research regarding their own behaviour are evaluated. When students rated themselves about accepting gifts/help in exchange for preferential treatment, they generally found this behaviour unethical. Students found it somewhat unethical to take on a job in an area they knew little about and completely unethical to blame an innocent colleague for a fault.

While students found it somewhat unethical not to support a colleague who is trying to do the right thing, they generally found it unethical to give gifts in exchange for preferential treatment. Demanding profits from someone else’s labour, not reporting that others violate corporate policies and disclosing confidential information are behaviours that students generally found unethical. Students found it somewhat unethical to withhold relevant information from a colleague or client, to file an excuse to take a day off and to steal institution materials. While dealing with personal work during study time is generally unethical by the students, it is not very unethical not to follow the latest developments in the field. It was generally found unethical to hide the mistakes made, taking extra personal time (breaks or leaving work early) somewhat unethical, and using corporate services for personal gain was generally unethical.

In Table 5, the ethical perceptions of engineering faculty students regarding the behaviour of their colleagues are evaluated.

Table 5. Ethical perceptions of students regarding the behaviour of their colleagues

No	Totally unethical		Generally unethical		A little unethical		Not so unethical		Not unethical at all		Total		
	F	%	F	%	F	%	F	%	F	%	F	%	Ort.
1	29	23,2	33	26,4	48	38,4	10	8	5	4	125	100	2,43
2	22	17,6	31	24,8	42	33,6	21	16,8	9	7,2	125	100	2,71
3	95	76	14	11,2	9	7,2	7	5,6	0	0	125	100	1,42
4	22	17,6	35	28	33	26,4	27	21,6	8	6,4	125	100	2,71
5	30	24	35	28	44	35,2	12	9,6	4	3,2	125	100	2,40
6	54	43,2	50	40	14	11,2	5	4	2	1,6	125	100	1,80
7	69	55,2	30	24	18	14,4	6	4,8	2	1,6	125	100	1,73
8	57	45,6	45	36	19	15,2	4	3,2	0	0	125	100	1,76
9	33	26,4	36	28,8	43	34,4	11	8,8	2	1,2	125	100	2,30
10	21	16,8	25	20	41	32,8	27	21,6	11	8,8	125	100	2,85
11	33	26,4	31	24,8	39	31,2	21	16,8	1	0,8	125	100	2,40
12	22	17,6	49	39,2	31	24,8	19	15,2	4	3,2	125	100	2,47
13	16	12,8	19	15,2	32	25,6	48	38,4	10	8	125	100	3,13
14	34	27,2	44	35,2	25	20	19	15,2	3	2,4	125	100	2,30
15	14	11,2	38	30,4	66	52,8	7	5,6	0	0	125	100	2,52
16	51	40,8	43	34,4	11	8,8	18	14,4	2	1,2	125	100	2,01

In Table 5, the ethical perceptions of the engineering faculty students participating in the research regarding the behaviours of their colleagues are evaluated. When students evaluated their colleagues about accepting gifts/help in exchange for preferential

treatment, they found this behaviour unethical in general. Students found it somewhat unethical to take on a job in an area they knew little about, and completely unethical to blame an innocent colleague for fault. While students found it somewhat unethical for their colleague not to support a colleague who is trying to do the right thing, they generally found it unethical to give gifts in exchange for preferential treatment.

Demanding profits from someone else's labour, not reporting that others violate corporate policies and disclosing confidential information were considered completely unethical behaviours. Withholding relevant information from a colleague or client was generally considered unethical, giving a sick excuse to take a day off was somewhat unethical and stealing corporate materials and dealing with personal business during work time were generally considered unethical. Students found it somewhat unethical that their colleagues did not follow the latest developments in their field. Hiding the mistakes, taking extra personal time (breaks or leaving work early) and using the services of the institution for personal gain were generally considered unethical by the students in terms of the behaviour of their colleagues.

4 Discussion

Engineering faculty students participating in the research evaluated 16 behaviours in the behaviour list from an ethical perspective. The research findings reveal that there is a difference between students' ethical perceptions about themselves and their colleagues. The students found the behaviours included in the behaviour list to be less unethical when they evaluated them from their own perspective, and they found the behaviours they evaluated in terms of their colleagues more unethical. Among the behaviours in the behaviour list, the behaviour with the lowest item evaluation interval was that blaming an innocent colleague; the students found this behaviour completely unethical for both themselves and their colleagues. Among the behaviours in the behaviour list, the behaviour with the highest item evaluation interval was not to following the latest developments in the respective field. While the students evaluated this behaviour as not very ethical for themselves, they evaluated it as somewhat unethical for their colleagues. Tas [23] stated that university students get high scores on ethical values such as love, respect, responsibility, transparency, trust, justice, equality and cooperation in his study examining the predisposition of university students to ethical values and related factors. In addition, students received low scores on ethical values such as being patient, being a role model and entrepreneurship. This situation can be evaluated as an indication that students are better in their relationships with others, but they are relatively weak in self-discipline and self-confidence, and therefore in internal ethics [24]. In a different study conducted in the field, Eweje and Brunton [25] evaluated the importance of age, gender and work experience on the ethical perceptions of business students at a New Zealand university. As a result of the research, it has been observed that women are more ethically conscious than men; age does not have an absolute effect on ethical awareness; and ethical awareness increases with work experience. Ocal [26] evaluated the perspectives of university students in the fight against corruption and bribery within the scope of business ethics. In the study, it has been

hypothesised that there is no big difference in the way male and female students view the subject, but that corruption and bribery may decrease, or at least remain constant, as a result of the participation of women, who give more importance to ethical values, in business life, albeit partially.

5 Conclusion

The debates on engineering ethics, which have been going on for many years both in our country and in the world, have gained much more different dimensions with advanced technologies. Accordingly, in this study, the professional ethical perception levels of engineering faculty students were evaluated. As a result of the research, it was determined that the ethical sensitivity of the engineering faculty students towards their colleagues was higher than the ethical sensitivity towards themselves. While students are more tolerant when they exhibit all the behaviours that can be evaluated within the scope of professional ethics, it has been observed that the tolerance decreases when they evaluate the same behaviours in terms of their colleagues. The results of the research indicate that the current personal ethical perceptions of engineering faculty students are not on a clear plane, and the steps to be taken in order to gain this clarity should be programmed systematically with the duties of higher education programmes.

6 Recommendations

The findings obtained from the research bring to mind the precautions to be taken in order to improve the ethical perceptions of engineering faculty students and to adopt ethical codes. These measures are as follows:

1. In order to increase the knowledge level of engineering faculty students about ethical principles and ethical codes, the course curricula should be rearranged.
2. The academic staff of the university should be supported with in-service training programmes on ethical leadership, and students should be sensitised about exhibiting exemplary behaviours.
3. In order to reinforce ethical behaviours, it should be ensured that an institutional culture is created in the university that will enable students to behave in accordance with moral values and norms.
4. Seminar programmes should be organised within the university at certain and regular intervals, in which ethical principles and codes are reminded and commitment to ethical values is strengthened.

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