Opinions of University Students on Technology Literacy

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Abstract—The aim of this study is to evaluate the views of engineering faculty students on technology literacy. This research was conducted using a qualitative research design. In accordance with the structure of the research, the phenomenology design was chosen from the qualitative research designs. The study group of the research consisted of 142 students studying at engineering faculties at various universities in Kazakhstan and who voluntarily agreed to participate in the research. In the study, the opinions of engineering faculty students on technology literacy were collected with a semi-structured interview form developed by the researchers. As a result of the research, students defined technology literacy as knowing the meaning and function of technology and using it effectively. In addition, they associated technology use in the profession with technology competencies and professional competencies. The majority of students put forward the knowledge of technology in technological competencies and being able to follow technological innovations in professional competencies as a prerequisite for the use of technology in the profession. The students participating in the research found themselves moderately competent in being technology literate. Technology literacy should be integrated with all curricula and the content of curricula should be arranged accordingly.

Keywords—technology, technology literacy, students' views

1 Introduction

It is very important for people to acquire basic computer knowledge and skills and to use this knowledge in modern life in terms of raising awareness among both themselves and future generations and leading this field. It can be thought that it would be correct to consider this learning process as computer literacy in short. Literacy, which we heard a lot in the 1950–1980 period, was replaced by computer literate and computer

literacy, especially with personal computers. Computer literacy can be defined as understanding the basic concepts of informatics and using basic computer programmes in one's own profession [1]. In parallel with the rapid continuation of technological developments in the current era, scientific knowledge must be understood in the education and training processes. Because in the information age, information must be used effectively. For this, individuals who make up the society are expected to be at a sufficient level in terms of technology literacy. In particular, the creation of technology literacy competencies of university students emerged as a requirement of the technology age we live in.

1.1 Theoretical and conceptual framework

Based on the new social structure, which is called the information society, there is a human figure who has trained himself in the best way, follows the developments closely, can renew what he knows according to the changing conditions of the day, can learn different things in line with the needs and is always open to learning and development. Accordingly, considering the developing information and communication technologies, it can be said that literacy does not only include reading and writing skills and making arithmetic calculations, but there is a shift towards information and technology literacy, which also includes computer skills. At this point, it is stated that literacy is the ability to communicate that allows people to be functional at a level that can sustain their lives using various symbols, and it requires the acquisition of certain skills in order for the individual to communicate with the society in which he lives [2].

Today, it can be stated that human life is surrounded by information and communication technologies, and the world is progressing with rapid changes, which are often difficult to follow on a path where technological developments are the determinants. These technologies play a central role in the modern age, spreading to all aspects of social life such as business life, education, public services, economy, management, health, entertainment and culture. From accessing information to interacting with public services to working at home, from cooperating with colleagues to communicating with friends or from taking distance education to political participation, our daily relationships are directly affected by information and communication technologies [3].

The level of access to technology, adoption of innovations, quality of the tools to be used in measuring the skills and practices in this regard, the proficiency levels of teachers in technology and the factors that lead to technology adoption are the factors affecting technology literacy [4].

Technology literacy includes not only the ability to use technology, but also the intellectual process, knowledge, competence and order that helps individuals make sense of the relationship between themselves and society [5]. As a different definition of a technology literate, it has also been used in the sense of reaching a fully developed form of digital citizenship, which facilitates the orientation towards the technological order [6].

Therefore, it is possible to say that technology literacy, which includes what people need to know in order to survive in the technological environment in which they live, includes various knowledge, skills and attitudes [7]. In the report document called

Techtally, which was published after a project carried out by the American National Research Council, three basic elements of technology literacy are expressed as knowledge and skills, critical thinking and decision-making [8].

A technology literate person is a person who critically questions the technological processes and innovations. A person who can question technology has an intellectual view that can analyse the benefits and drawbacks of technological developments, their costs and the political and social forces that can advance or stop the developments. The important point here is to emphasise the place of technology in our daily life and to raise awareness about the coexistence of technology and contemporary life [8].

The technology that develops in line with the needs of the society must be understood by the individuals who make up the society. An individual who is technology literate can easily understand his relationships with society. In this context, in the field of education, which constitutes an important dimension of progress, technology education at all levels, from primary education to higher education, should be reorganised in accordance with the requirements of the age and should be included in the curriculum more heavily [9].

1.2 Related research

Leu et al. [10] stated that skills and strategies required for Internet use require a higher level of knowledge; accordingly, it has been revealed that electronic environments require a higher level of literacy and a critical perspective.

Bagley et al. [11] analysed the integration of technology-related practices into education by communicating with a social studies teacher for 5 years. In the research, how the problems encountered in this field are overcome and the benefits of using technology for teachers and students are revealed. It has also been demonstrated that this teacher is successful in helping her students acquire new or improve existing skills in technology, critical thinking, collaboration, presentation and self-learning. In the research conducted by Castillo [12], it was aimed to determine the technology literacy of the students who took and did not take technology courses, and it was concluded that a module programme based on technology literacy standards increased the technology literacy levels of students. Rock and Passe [13], on the other hand, conducted a study to reveal the level of application of technology-supported education applications on social studies education at the university level. As a result of the study, they revealed that the use of technology is under the influence of economic, political, social and technological variables. Accordingly, the economic dimension affects the creation of technology classes and laboratories, the political dimension affects the determination of the goals of the programme, and the social dimension affects the popularity of using technology in teaching.

In their study, Debbag and Fidan [14] determined five dimensions for technology literacy: ‘the foundations of technology’, ‘the effect of technology on human life’, ‘applicability’, ‘production and design’ and ‘evaluation and sustainability’. In the research, the historical process and development of the basic concepts such as computer, Internet, programming, software were in terms of the dimension of ‘the foundations of technology’ in information technologies teaching programmes; in the ‘production and design’

dimension, it has been concluded that the acquisitions for design principles, creativity and developing a technological product are lacking.

In the study of Elmas, Kete, Fastsoy and Kumral [15] on 'The effect of technological device usage habits on school success', it was determined that it is known that the use of technology for educational purposes positively affects school success, and according to the findings obtained within the scope of the research, the use of technology other than educational purposes also affects school success. In order to increase school success, it is necessary to limit the use of technological tools and equipment (being on the Internet, playing computer games etc.). However, teachers and school administrators who expressed their opinions within the scope of the research stated that technology should be used positively and within the educational process.

1.3 Purpose of the research

The purpose of this research is to evaluate the views of engineering faculty students on technology literacy. Depending on this purpose, the research seeks answers for the following sub-objectives:

1. What does technology literacy mean for students?
2. What are the students' views on the use of technology in education?
3. What are the students' views on the level of seeing themselves as technology literate?

2 Method and materials

This section contains information about the research method and the data collection tool prepared in line with the determined method. In addition, information about the working group, data collection process and data evaluation are also detailed.

2.1 Research method

This research was conducted using a qualitative research design. In accordance with the structure of the research, the phenomenology design was chosen from the qualitative research designs. The phenomenology pattern focuses on phenomena that we are aware of but do not have a deep understanding of. These phenomena can appear in various forms such as events, experiences, perceptions, orientations, concepts and situations in the world we live in. Studies carried out in the phenomenological pattern are based on the view that the reality in organisational formation has a structure from the common to the extraordinary and from the general to the specific [16]. In the research, phenomenology design was chosen in order to evaluate the views of engineering faculty students on technology literacy.

2.2 Participants

The study group of the research was formed by the criterion sampling method, one of the purposive sampling methods. The basic understanding in this sampling method is the study of situations that meet predetermined criteria. These criteria are created by researchers [17]. Depending on the nature of the research, it was found appropriate to choose this sampling method. The study group of the research consists of students who are studying in engineering faculties at various universities in Kazakhstan and who voluntarily agreed to participate in the research. The demographic information of 142 engineering faculty students participating in the research is provided in Table 1.

Table 1. Öğrencilerin demografik özellikleri

Class	Gender		Sum	
	Female	***Male***	***F***	***%***
1. Class	17	8	25	17,6
2. Class	10	19	29	20,4
3. Class	21	38	59	41,5
4. Class	15	14	29	20,4
Sum	63	79	142	100

In Table 1, the demographic characteristics of the students participating in the research regarding the class and gender distribution are provided. 17.6% of the students participating in the research are in the 1st year, 20.4% are 2nd year, 41.5% are 3rd year and 20.4% are 4th-year students. It is possible to say that the number of third-year students participating in the research is more than the students studying in other classes. In addition, 63 female and 79 male students participated in the study.

2.3 Data collection tools

In this study, the opinions of engineering faculty students on technology literacy were collected through a semi-structured interview form developed by the researchers. The questions in the semi-structured interview form were determined by scanning the literature. The prepared semi-structured interview form was presented to the expert opinion, and the final form of the form was created in line with the opinions of the experts. The final form of the form was pre-interviewed with five students and the clarity of the questions in the semi-structured interview form was tested. As a result of the preliminary opinion, it was concluded that the questions were understandable. Five students who were pre-interviewed were not included in the study group. The questions in the semi-structured interview form were directed to the study group through in-depth interviews. The aim of in-depth interviews is to focus on the researched subject and to bring together the opinions and evaluations of individuals around this subject [18]. The semi-structured interview form is given in Annex-1.

2.4 Data collection process

Interviews were primarily planned regarding the semi-structured interview form applied to the study group with in-depth interview technique. As a result of the appointments made from the students, the interviews were made face-to-face and one-on-one at a place determined within the university. The answers given to the questions asked to the students in the interviews were noted by the researchers. In addition, the interviews were recorded with a voice recorder, with the permission of the students, in order to eliminate the deficiencies that may occur while writing and to eliminate misunderstanding. The questions in the semi-structured interview form were asked to the students in the order given. Explanations were made when necessary. The interviews lasted for approximately 30–35 minutes.

2.5 Data collection analysis

The data obtained from the semi-structured interview form prepared by the researchers were primarily divided into themes. Then the themes were analysed by the typological analysis method. In typological analysis, typical situations are defined, data are read and coding is condcted according to typologies. Generalisations are reached by deciding whether the identified common themes are supported by the data obtained [19]. The findings obtained from the research were interpreted in line with the students' views on technology literacy and presented in line with the purpose and sub-objectives of the research.

3 Results

In this section, there is an analysis of the answers given by the study group of the research to the questions in the semi-structured interview form.

Table 2 shows the opinions of the students participating in the research about what technology literacy means to them.

Table 2. Students' views on what technology literacy means to them

Categories	F	%
Knowing the meaning and function of technology and being able to use it effectively	116	81,6
Ability to use technological products and systems	101	71,1
To understand the fields of activity and features of technology	88	61,9
To be able to evaluate the quality of technological products and systems	63	44,3
To be able to comprehend the effects of technology on cultural, social and business life.	51	35,9
Making a connection between technology and professional knowledge	39	27,4
Having problem-solving skills in the use of technology	27	19
Contributing to the development and use of technology	9	6,3

In Table 2, students' views on what technology literacy means to them are categorised based on their definitions. 81.6% of the students defined technology literacy as knowing the meaning and function of technology and using it effectively. While 71.1% of the students defined technology literacy as being able to use technological products and systems, 61.9% defined it as being able to comprehend the fields of activity and features of technology. 44.3% of the students participating in the research made the definition of evaluating the quality of technological products and systems and 35.9% of them defined the effects of technology on cultural, social and business life. Technology literacy was defined by 27.4% of the students as making a connection between technology and professional knowledge and having problem-solving skills in the use of technology by 19%. Finally, 6.3% of the students described technology literacy as being able to contribute to the development and use of technology.

The opinions of some students who participated in the research about what technology literacy means to them are given below with direct quotations.

S-1: *In my opinion, technology literacy is being able to use technological products. In addition, being able to overcome the problems that may be encountered while using technology without assistance can be defined as technology literacy.*

S-42: *Being able to solve the problems encountered while using technology, following the technological innovations with interest and having knowledge about the nature of technological products can be defined as technology literacy.*

S-73*: First of all, I think it is important to know what technology is. So is being able to take advantage of technology. The integration of technology knowledge into the profession can also be technology literacy.*

S-10: *Just knowing what technology is is not enough. In addition to having a command of the function of technology, it is also necessary to have a command of technological products and systems. In addition, I think it is very important to contribute to technology. In other words, to be able to develop a technological tool or develop a system. Thus, a contribution is made to the use of technology. I believe that these characteristics should be present in individuals who are defined as technology literate.*

S-136: *I think many features such as being aware of the impact of technology on social life, being able to follow technological products and innovations, understanding what technology is and what it is used for, and knowing the characteristics of technology are necessary for technology literacy.*

In Table 3, the opinions of the students participating in the research on the use of technology in the profession were evaluated.

Table 3. Opinions of students on the use of technology in the profession

Categories	Subcategories	F	%
Technology competencies	Technology knowledge	103	72,5
	Technical skills	65	45,7
	Ability to use technology	46	32,3
	Ability to choose the appropriate technology	18	12,6
Professional competencies	Ability to follow technological innovations	109	76,7
	Creativity	81	57
	Foreign language knowledge	66	46,4
	Problem solving ability	29	20,4

In Table 3, the opinions of the students participating in the research on the use of technology in the profession are categorised. In line with student opinions, the use of technology in the profession is divided into two categories as technology competencies and professional competencies. Students learn technology competencies; the sub-categories are technology knowledge, technical skills, ability to use technology and choosing the appropriate technology. Professional competencies were evaluated by the students in the following sub-categories: technological innovations, creativity, foreign language knowledge and problem-solving ability. In the category of technology competencies, they associated technology use in the profession with technology knowledge with 72.5%, technical skills with 45.7%, using technology with 32.3% and choosing the appropriate technology with 12.6%. In the category of professional competencies, 76.7% of them stated that it is related to technological innovations, 57% to creativity, 46.4% to foreign language knowledge and 20.4% to problem-solving ability.

The opinions of some students who participated in the research on the use of technology in the profession are given below with direct quotations.

S-19: *For the use of technology in the profession, first of all, technology knowledge is needed. Of course, there should be a desire to follow technological innovations. Technology also has a direct connection with foreign language knowledge. In order to follow technological innovations faster and to understand technological systems more easily, English is especially necessary.*

S-4: *I think it is necessary to follow the technology, to know the technology and to have the ability to use it. For example, I still consider myself inadequate in some areas. I am extremely incapable of keeping up with innovations.*

S-140: *It is important to use technology correctly. Of course, technology knowledge should be based. However, it is also very important to know which technological applications to use and where. This is where creativity comes into play. The problem-solving skills of the person are also very effective on which technology will be used.*

S-29: *In order to use technology correctly in the profession, it is necessary to constantly follow the innovations. In my opinion, keeping up with technological developments, improving oneself, being solution-oriented and having the ability to use technology are prerequisites for the use of technology in the profession.*

S-109: *In order to be able to use technology effectively in the field of profession, first of all, it is necessary to have technology knowledge and the ability to use technology. Technical knowledge and the ability to use this technical knowledge to solve the current problem are also required. It is necessary to follow the developments constantly, to be open to new learnings, and to know a foreign language in order to do this.*

In Table 4, the opinions of the students participating in the research regarding the level of seeing themselves as technology literate are evaluated.

Table 4. Opinions of students regarding their level of seeing themselves as a technology literate

Categories	F	%
I find it very sufficient	11	7,7
I find enough	18	12,6
I find it moderate enough	73	51,4
I find it insufficient	31	21,8
I find it very insufficient.	9	6,3
Sum	142	100

In Table 4, the views of the students participating in the research regarding the level of seeing themselves as technology literate are categorised. 7.7% of the students stated 'I find it very sufficient', 12.6% stated 'I find them sufficient', 51.4% stated 'I find them moderately sufficient', 21.8% stated 'I find them insufficient' and 6.3% stated 'I find it very inadequate'. It has been determined that the majority of the students participating in the research find themselves moderately sufficient to be technology literate.

The opinions of some students who participated in the research regarding the level of seeing themselves as technology literate are given below with direct quotations.

S-139: *I can explain what computer hardware parts do. I can prepare my personal website. Pascal, Java etc. I can find errors in a programme written with a computer programme. I use several drawing programmes well. (I find it very sufficient)*

S-23: *I think I know the computer sufficiently. I can say that I am proficient in information technologies. For example, if the computer's operating system crashes, I can reinstall it. I can learn a computer programme quickly. (I find it enough)*

S-12: *I have basic computer usage knowledge. I can use some programmes such as Word, Excel, Freehand, Photoshop well. However, I still don't think that all of these make me tech literate. There are many things to know. (I find it moderately sufficient)*

S-77: *I have basic basic knowledge. I do not think that this information is sufficient for a person to define himself/herself as technology literate. I can use web search engines. I can do basic operations such as opening a compressed file, sending mail, and playing a cd. Add pictures, sound, movies, etc. to the presentation. I can add and remove objects. (I find it insufficient)*

S-91: *Except for simple information, I cannot say that it is a programme or software that I know professionally. I find myself very inadequate in this field. (I find it very inadequate)*

4 Discussion

Research findings reveal that the majority of students define technology literacy as knowing the meaning and function of technology and being able to use it effectively. In his study, Taylor (2004) investigated which dimensions the activities of the Technology Students Association affected technology literacy. The concept of technology has revealed the impact on dimensions such as its effects on society, the solution of technology-related problems, the design process and sub-systems. De Vries and Tamir

[20], in their study, stated that although there are difficulties in defining technology because it is a very comprehensive term, the structure and content of this concept should be revealed first when discussing the subject of technology. Rohaan et al. [21] similarly stated in their study that students' correct and comprehensive understanding of technology plays a major role in developing positive attitudes towards technology.

The students participating in the research stated that the use of technology in the profession would be possible primarily by having technology competencies. Technology competencies are technology knowledge, technical skills, the ability to use technology and the ability to choose the appropriate technology. Another condition that students put forward in the use of technology in the profession is professional competencies. Students categorised their professional competencies as follows: technological innovations, creativity, foreign language knowledge and problem-solving ability. In his study, Marri [22] reveals that the use of technology provides students with gains such as handling different perspectives and benefiting from data processing skills.

In his study, Wicklein [23] stated that the technological literacy goal can be achieved by organising the technology education high school curriculum around the engineering design study. In the study, the importance of the design process and active participation of students in technology education and therefore in the development of technology literacy has been revealed.

The students participating in the research were asked about their level of seeing themselves as technology literate, and the majority of students stated that they found themselves moderately competent. Students who found themselves moderately competent were followed by those who found themselves inadequate. The research findings revealed that the number of students who found themselves sufficient, very competent and very inadequate in technology literacy is quite low. The results of the study conducted by Olson [24] and the results of this study overlap. In the study, the perceptions of the students who graduated from the 12th grade about technology and their skills were examined, and as a result of the interviews, it was determined that the students saw themselves as sufficient in this subject at an average level.

In his study, Dakers (2014) defined technology literacy as an important part of human development. In the research, it was emphasised that learning and teaching environments should be structured in accordance with interdisciplinary interaction in order to gain technology literate individuals.

5 Conclusion

Technology literacy in the technology world we live in is among the skills that individuals should have. Accordingly, in this study, the views of engineering faculty students on technology literacy were evaluated. The students participating in the research defined technology literacy as knowing the meaning and function of technology and being able to use it effectively. In addition, students associated technology use in the profession with technology competencies and professional competencies. The majority of students put forward the knowledge of technology in technological competencies and being able to follow technological innovations in professional competencies as a

prerequisite for the use of technology in the profession. The students participating in the research found themselves moderately competent in being technology literate.

6 Recommendations

In line with the results obtained from the research, the following suggestions were developed that can affect the development of students in the field of technology literacy. These recommendations are:

1. Technology literacy should be integrated with all curricula and the content of curricula should be arranged accordingly.
2. In order to train teachers who will contribute to the development of students' technology literacy, education faculties should attach importance to technology education and content aimed at increasing the technology literacy of teacher candidates should be included in all programmes.
3. The content of technology-related courses given in engineering faculties should be enriched and linked with technology literacy.
4. In order for the technology education to be given for the development of technology literacy to be successful, cooperation should be established between schools and leading institutions serving in the field of technology in the national sense, and various projects and joint studies should be organised.

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Annex-1 Semi-structured interview form

Description: In this research, ıt is aimed to evaluate the views of engineering faculty students on technology literacy. In this direction, your opinions will be taken in line with the negotiations to be held with you.

Interviews will be recorded with a voice recorder when necessary and your permission is required for this. The information obtained at the end of the research will be

used for scientific purposes only. Your real name will not be stated in the research report, instead coding will be used.

The estimated duration of the interview is determined as 30–35 minutes. Thank you in advance for your participation and sharing valuable information.

Student's class:……..……..……

Student's gender:…….……..……..….

1. What does the concept of technology literacy mean to you?
   Response:……
2. What are your views on the use of technology in the profession?
   Response:……
   …….
3. What is your level of seeing yourself as a technology literate?
   Response:……

I find it very sufficient	I find it enough	I find it moderately sufficient	I find it insufficient	I find it very insufficient.