

Primary School Students' Perceptions Of Technology

[1] Assoc. Prof.
Sakarya University, Faculty of
Education
Department of Science Education
fbalkan@sakarya.edu.tr

Fatime BALKAN KIYICI [1]

<http://dx.doi.org/10.17220/mojet.2018.04.005>

ABSTRACT

It was aimed with this study to identify primary school fourth-grade students' perceptions of technology. The study was designed as phenomenology method. The participants of the research were composed of 58 primary school fourth-grade students attending to a public school. The research data were obtained through picture drawing, metaphors, Word Association Test, and semi-structured interviews. The findings showed that the students had similar perceptions of technology and they associated the concept of technology rather with higher tech products. They also defined technology as things that make things easier and emphasized that it has positive and negative aspects.

Keywords: *Technology, student, technology perception, technology literacy*

INTRODUCTION

As well as scientific and technological advancements, the ability to perceive and manage these advancements and technology reflect the level of development of countries. Education is the most important and effective factor that can bring this ability to individuals. According to Şenel and Gençoğlu (2003), the process of education, especially the education provided to bring technological literacy to individuals is of particular importance. Well-trained and qualified manpower that can be achieved by this means could minimize the problems to be posed by globalization such as technological, social, economic, political and cultural incompatibility.

Technology is a word that we repeated much and use commonly in our everyday lives. However, the concept is mostly misused as it is yet to be defined completely and the concept improves along with the changing and developing society and new meanings are added to it.

Scientists of different branches (e.g. philosophers, anthropologists, sociologists, historians, and teacher educators) have tried to handle the concept of technology from different perspectives, scrutinize and define it (Hansen & Froelich, 1994). As a result, discipline-specific definitions have emerged. The people use technology and utilize resources to improve humans' potential and to modify their environment (Pytlík, Lauda & Johnson, 1978; Hayden, 1990). Technology and technological paradigm should not be reduced to device or process because technology is more complex than them and it affects society (Staudenmaier, 1985; DeVore, 1980).

Rather than reducing the definition of technology to a single one and expecting all scientists to agree on one concept, it can be argued that it is more appropriate to identify basic points and expect consensus on those points. According to McRobbie, Ginns, & Stein, (2000); technology comes with five dimensions which are "has a human dimension, has a social dimension, is a process, is situated and leads to the development of products, or artefacts". However, recent research studies have shown an increased frequency of perception of technology as state-of-art technological products. Research regarding use of educational

technology usage consider technology as a high-level technology such as computer, internet, television etc. Teachers' voice and selection of technology can change students' idea and perception of technology (Mundy, Kupczynski & Kee, 2012; Li & Ni, 2011; Shuell & Farber, 2001; Kalonde & Mousa, 2016; Pierce & Ball, 2009; Pierce & Stacey, 2013; Lim, Zhao, Tondeur, Chai & Chin-Chung, 2013). The use of technology by reducing it to a single product or machine causes the concept to become smaller and be misunderstood. It is, on the contrary, a process in which both technique and knowledge play a key role (Locatis, 1987).

While technology manifests an incredibly rapid change, reflections of this rapid change is observed in several technological devices (Sunny, Patrick & Rob, 2018; Khasawneh, 2018). Speed of the technology change also makes it more difficult for individuals and society to perceive the concept. A concept difficult to be perceived and defined is also difficult to be taught. Even though the relationship between science and technology is yet to be explored clearly, both concepts contribute to each other's development. Advancements in technology contribute to science's data collection and analysis and the data obtained through scientific processes help technology to improve. Scientists handling with technology in modern societies utilize different approaches in the process of defining technology so that technology can be perceived properly (Payne, 1996).

The purpose of technology education should be to adapt to changes and learn how to make use of different technology rather than just teaching a certain technology to students (Kärkkäinen & Keinonen, 2010). Students will be able to make use of technological developments that they will face in any stage of their social life once they graduate. On the other hand, technology education aims to help students make sensitive choices and do it by following the ethical, spiritual and equality principles (Kärkkäinen & Keinonen, 2010). Later in life, individuals should be able to make use of technology and its influences, make technological judgements and direct the technology although technology might not be their focus in their future jobs. In this process, teachers' perception of technology, their technological knowledge and experience will shape their students' technological experiences. Hence, teachers need to be trained with positive technological experiences so that they can provide their students with positive technological experiences (Kalonde & Mousa, 2016).

Different perceptions of technology by individuals may bring about several problems. For instance, Jarvis & Rennie (1998) states that some teachers perceive technology as scientific practices while others perceive it as modeling. This affects not only their choices about technology and use of technology with their colleagues but also their use and policies of technology in the classrooms. Woolnough (1990) reported that boys had more positive attitudes to technology and girls had more unfavorable view of technology and its effects on environments (cited in McRobbie, Ginns, & Stein, 2000). Vries (1986) also reported that pupils are aware of the diversity of technology (cited in McRobbie, Ginns, & Stein, 2000). As can be understood from these studies, students may develop certain knowledge of technology and its effects. Positive orientation of this knowledge and experience depends on teacher and family. For example, Woolnough (1990) and Vries (1986) stated that the students were more positive toward technology in the cases where the members of their families were working in a technology-related job (cited in McRobbie, Ginns, & Stein, 2000).

Research studies show that people of all ages use technology. Technology is somehow utilized in every domain, especially in educational-instructional settings (Özdemir, 2010). Some individuals report that technology makes life easier while others think that technology makes individuals anti-social (Batur & Uygun, 2012). In the study conducted by Herdem, Aygün & Çinici, (2014), it was seen that the students frequently gave examples of technology from everyday life. The general result achieved from the data that were obtained through cartoons is that technology makes life easier. On the other hand, the study found that some of the students felt technological developments affect our lives negatively. Another study performed by Aydın (2011) tried to identify elementary school sixth-, seventh- and eighth-grade students' views of technology. It was concluded in the study that the students generally described technology as advanced technologies and constructed some of the daily electronic appliances as technology. Most students think of technology not as a process but a product. Such perception can influence their learning of technological concepts and processes (Sidawi, 2009). To change this perception, it is necessary for students to address aspects of technology and be able to develop different definitions of technology and be raised as

technologically literate individuals. They also need to be made understand that technology is not only about hi-tech devices and perceive the concept and development of technology by teaching them the design processes. Based on these considerations, thinking that technology is an inseparable part of our life, it is an inevitable truth that it is of importance to examine students' perception of technology in depth. The studies regarding technology perception that has participants form primary schools students, are not common in literature.

Purpose

This study aimed to identify primary school fourth-grade students' perceptions of technology.

METHODOLOGY

The study was designed in phenomenology method. Phenomenology aims at gaining a deeper understanding of nature or meaning of our everyday experience (Patton, 2002 p.104).

Participants

The participants of the research were composed of 58 primary school fourth-grade students attending a public school. The school was preferred so that there could be cooperation in the process of choosing the participants. Next, consents of both school administration and parents were taken, and the study was carried out with the volunteered students. Certain demographics of the participants are shown in the table below.

Table 1. Participants' demographics

		Frequency	Percentage
Gender	Female	30	51.72
	Male	28	48.27
*Ownership Technological devices	Computer	36	28.80
	Tablet	40	32.00
	Phone	38	30.40
	Other (TV, PS4, etc.)	11	8.80
*Purpose of usage	Homework	45	45
	Gaming	40	40
	Other (Research, entertainment, etc.)	15	15

*Participants selected more than one options here.

Table 1 gives some demographics of the participants. 51.72% of the participants are girls and 48.27% are boys. Regarding the technological devices in their possession, more than half of the participants had a computer, phone, tablet or more thereof. The participants reported that they were using the technological devices mostly for homework and gaming.

Data Collection and Analysis

As the purpose of the study was to examine primary school fourth-grade students' perception of technology which is in every domain of daily life in depth, picture drawing, metaphors, Word Association Test and semi-structured interviews were utilized as data collection instruments.

- **Picture drawing:** The students were asked the questions *"What do you think when I say 'Technology and Our Life'? Can you draw a picture about it?"* to find out children's perception of technology and where it is situated in their lives. In this method, children regulate and interpret their perceptions and observations of the surroundings according to their own views. By this means, they tell about how they perceive the outer world, in other words, the way they perceive it (Belet and Türkkan, 2007).
- **Metaphors:** Metaphors were utilized in this study as a data collection instrument to determine what the students perceive about the concept of technology. Metaphor is that an individual tries to explain a concept or phenomenon using similes (Aydın, 2010). Since the students were younger and going through the concrete operational stage, it was anticipated that metaphors would contribute to the determination of how they perceive the concept.
- **Word Association Test:** One of the instruments utilized in the data collection process is Word Association Test (WAT). WAT is a technique that can be used for understanding individuals' perception and understanding of a given concept (Özata-Yücel & Özkan, 2014). When preparing the WAT, the concept of "technology" was set as the keyword. Next, a test about the concept was prepared and the same concept was written down one under the other for 10 times. Before the actual application, a pilot application was conducted with a different concept in the classroom so that the students could practice the WAT, and the data were collected in the end.
- **Semi-structured interview:** Semi-structured interviews were performed with 11 students to get more detailed information on students' perception of technology. Semi-structured interviews help researcher acquire information through a previously created interview form and provide flexibility (Creswell, 1998; Yıldırım & Şimşek, 2006). Two experts of science education, one expert of computer education and instructional technologies and one classroom teacher were consulted for opinions during the preparation of interview questions. The interview questions were finalized according to the feedbacks. The questions were about what technology is, what it means to them, its place and importance in their lives.

Data Analysis

The pictures were subjected to a content analysis, and elements in each picture were coded by two researchers separately. The consistency between the researchers was calculated according to the formula $\text{Agreement}/(\text{Agreement} + \text{Disagreement})$ by Miles and Huberman (1994) and found to be 94.5%. It is thought that the reason why consistency was so high is that the students wrote down what they meant with the drawing in a balloon next to the element and it reduced the error of margin in the analysis.

The stages of naming, classification, reorganization and compilation, category development and ensuring validity and reliability described by Çapan (2010) were considered in the analysis of the data obtained from the metaphors. The metaphors previously developed were listed as concepts, and metaphors that could be subjected to evaluation were decided. The papers on which no metaphors were defined or the area of justification was left blank were excluded and not included in the analysis. Accordingly, metaphors produced by 47 students in total were evaluated. Metaphors rearranged, compiled and subjected to analysis were examined for similarities, and categories were created. With the help of a computer education and instructional technologies expert, it was ensured that the categories and metaphors were consistent. The reason why the number of evaluated metaphors were fewer than the number of participants is thought to be the fact that the participants might have found it hard to produce metaphors as they were junior.

In the analysis of the data obtained in WAT, the answers given by the students for the keyword were listed, and the frequency of these answers were calculated. Based on the frequency table, the graphics were drawn, and the findings were presented visually.

A content analysis was conducted on the semi-structured interviews performed to acquire more detailed information the students' perception of technology. The data were first transcribed. Next, they were encoded and thematized by two independent researchers. The consistency between codes was calculated according to the formula Agreement/(Agreement+ Disagreement) by Miles and Huberman (1994) and found to be 90.4%.

FINDINGS

The findings achieved in the analysis of the data which were obtained with the data collection instruments are provided below.

Findings Achieved in the Analysis of Pictures

Table 2. Findings achieved in the analysis of students' pictures

Codes	Frequency	Percentage
Phone	38	20.65
Computer	35	19.02
Television	32	17.39
Tablet	18	9.78
Robot	12	6.52
Gaming console	5	2.72
Projector	4	2.17
Light bulb	4	2.17
Media player	4	2.17
Refrigerator	3	1.63
Smart whiteboard	2	1.09
Radio	2	1.09
Pencil	2	1.09
Vacuum Cleaner	2	1.09
Microwave Owen	2	1.09
Washing Machine	2	1.09
WhatsApp	2	1.09
Other	15	8.15

As seen in Table 2, according to the pictures drawn by the students, they drew about high-tech devices such as phones, computers, televisions, tablets and robots and devices used at home daily (light bulb, washing machine, microwave oven, etc.)



Picture 1. Examples of pictures drawn by the students (S_{36} , S_{37} , S_{40})

Findings Achieved in the Analysis of Answers Given by Students in the Word Association Test

Number of different answer words provided by the students for the keyword “technology” is 136. This might give an opinion on what level the students were regarding the association of technology with different concepts.

As for the number of answer words given by the students, it was decided that the first cut-off point would be >55, the cut-off point was flexed by 10 points every time, and the graphic kept being drawn until the cut-off point was >5. The graphic drawn according to the answers given by the students for the keyword “technology” is shown in Figure 1.

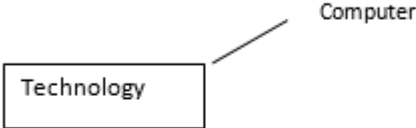
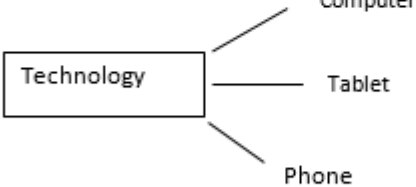
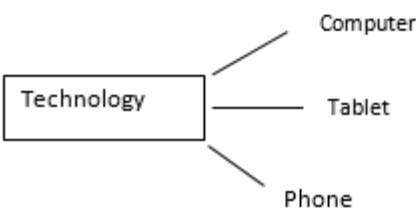
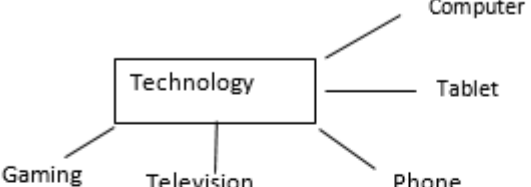
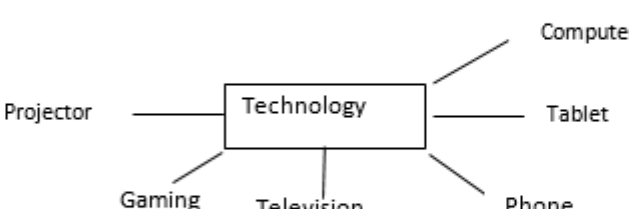
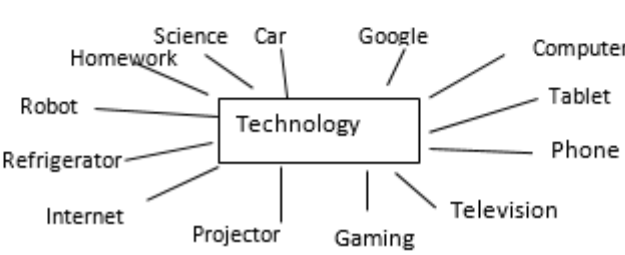
Cut-off point (COP)	Graphic
≥ 55	
$55 \geq BP \geq 45$	
$45 \geq BP \geq 35$	
$35 \geq BP \geq 25$	
$25 \geq BP \geq 15$	
$15 \geq BP \geq 5$	

Figure 1. Graphic drawn according to the answers given by students

As seen in Figure 1, the students associated the concept of “technology” with “computer” ($BP \geq 55$) most. In other words, more than 55 of the students used the word “computer” in their answer words. When flexing the cut-off point for once ($55 \geq BP \geq 45$), the words “tablet” and “phone” appeared. “Television” and “gaming” were added to the existing ones when flexing the cut-off point for the second time ($35 \geq BP \geq 25$). By flexing the cut-off point once again ($25 \geq BP \geq 15$), the word “projector” was added to the graphic. When

bringing the cut-off point to the range of $15 \geq BP \geq 5$ by flexing it once again, words “Internet”, “science”, “robot”, “homework”, “refrigerator”, “car”, and “Google” emerged. Examining the student answers in such a way that the cut-off point was smaller than 5, tools-appliances frequently used at home in everyday life (vacuum cleaner, oven, coffeemaker, etc.) and more specific devices related to computer (keyboard, microphone, speakers, headphones, etc.) were added to the graphic.

Findings Achieved in the Analysis of Metaphors Made by Students

The students produced 47 metaphors about technology in total. These metaphors were grouped in two themes which reflect positive (22 metaphors) and negative (25 metaphors) aspects of technology.

Table 3. Findings Achieved in the Analysis of Metaphors

	Category	Metaphor	Frequency	Percentage
Positive aspects	Source of Information	Friend	1	
		Book	2	
		Professor	2	
		Brain	2	
		Father	2	72.72
		Teacher	3	
		Mind	1	
		Encyclopedia	1	
		Mother	1	
		Remedy	1	
	Source of Entertainment	Gaming	1	
		Amusement Park	1	9.09
Ever-Developing and Source of Development	Life	3		
	Hero	1	18.18	
Negative aspects	Source of Disease/Problem	Poison	2	
		Bad Friend	1	
		Disease	2	
		Enemy	3	64
		Pain	1	
		Evil	1	
		Death	1	
		Microbe	1	
		Virus	1	
		Microscopic Organism	1	
		Monster	1	
		Contaminated Water	1	
	Causing Addiction	Bird in the Cage	1	
		Microbe	1	
		Tick	1	16
Disease		1		
Eliminating the Sense of Time	Magnet	1		
	Imprisonment	1	12	
	Labyrinth	1		
Causing Anti-Sociality	Monster	1		
	Darkroom	1		

Considering the findings obtained about the metaphors that the students developed on technology, metaphors on positive aspects of technology were grouped in 3 conceptual categories "Source of Information", "Source of Entertainment", and "Ever-Developing and Source of Development".

There were 4 conceptual categories of metaphors developed on negative aspects of technology, which are "Source of Disease/Problem", "Causing Addiction", "Eliminating the Sense of Time", and "Causing Anti-Sociality".

The following is direct quotes from the student metaphors:

"Technology is like a teacher because I can learn everything from it." (S₂₆)

"Technology is like a book because I can find everything I am looking for." (S₃₃)

"Technology is like poison because it affects our health negatively." (S₄₇)

"Technology is like a tick because it causes addiction." (S₄₇)

Findings Achieved in the Analysis of Semi-Structured Interviews

The findings achieved in the analysis of the semi-structured interviews which were conducted to identify students' perception of technology are presented below.

Table 4. Findings achieved in the analysis of semi-structured interviews about the question "What is Technology?"

Codes	Frequency	Percentage
Things that make it easier for us	8	61.53
Tools that serve us	2	15.38
Any tool that has both good and bad sides	2	15.38
Everything that runs on electricity	1	7.69

According to the opinions of the students interviewed in the study, majority (61.53%) of them defined technology as things that make it easier for us and 15.38% of them as tools that serve us. Part (15.38%) of the students defined technology as any tool that has both good and bad sides (Table 4).

Table 5. Findings achieved in the analysis of semi-structured interviews about the question "What if there was no technology?"

Codes	Frequency	Percentage
Things would be harder	10	71.42
There would be no communication	1	7.14
We could not have fun	1	7.14
We could not play	1	7.14
There would be waste of time	1	7.14

According to the answers given the the question "What if there was no technology?" in Table 5, majority (71.46%) of the students stated that "things would be harder".

The following is the direct quotes from the student opinions in the semi-structured interviews:

"Things that make it easier for us..." (S₁)

"Things would be harder. We would be writing with nails instead of pencils..." (S₆)

Discussion and Conclusion

In this study which aimed to identify primary school fourth-grade students' perception of technology, the participant students had similar perceptions of technology. In the analysis of the data of technology perception obtained with different instruments, the findings showed that the students associated the concept of technology rather with higher-tech products. In the pictures drawn by the students about the influence of technology on our lives, few students drew about simpler tools such as pencil, light bulb, etc. while majority of them used high-tech devices in their pictures such as phones, computers, televisions, tablets, and robots, etc. Similarly, there are studies in the literature in which primary and secondary school students emphasized high-tech products such as computers, Internet, phones, and televisions (Erişti & Kurt, 2011; Aydın, 2011; Herdem, Aygün & Çinici, 2014; Solomonidou & Tasios, 2007). The reason why students' perception of technology covers these products can be explained with decreased prices of the products and the fact that they have become more accessible and common for students. As mentioned in the literature, the reason might also be that concept of technology cannot be properly perceived by individuals.

These results achieved from the pictures coincide with the results of the Word Association Test. According to the WAT results, devices such as phones, computers, televisions, and tablets, etc. were associated with technology. Regarding these findings, the fact that the students mentioned early technological products less frequently is an anticipated outcome in this digital age. Indeed, today's younger generation which is called digital natives is born and raised amidst the latest technologies in this era (Karabulut, 2015). Therefore, it can be argued that new-age children have an awareness of current technologies.

As for the findings obtained from the metaphors which were developed by the students about technology, the students developed metaphors related to both positive and negative aspects of technology. This result is important in regard to efficient use of technology and the need for including technology in our life in awareness of the advantage-disadvantage relationship. Because being aware of positive and negative aspects of technology help people shape their standards of life (Herdem, Aygün & Çinici, 2014). Regarding technology's positive aspect of serving the purpose of use, the students featured the categories "Source of Information" and "Source of Entertainment". As for the demographics of the participant students, majority of them reported that they used technology in their possession for homework and gaming.

Aside from the positive aspects, the students provided negative opinions on technology such as "Source of Disease/Problem", "Causing Addiction", "Eliminating the Sense of Time", and "Causing Anti-Sociality". Similarly, some studies that participants' opinions on educational use of technology concluded that the students stated technology is useful, facilitates access to information, makes lessons more fun while it causes harms such as several health problems, addiction and social problems in their social lives (Batur & Uygun, 2012; Fidan, 2014; Durukan, Hacıoğlu & Dönmez Usta, 2016)

In the interviews performed with some of the participants in the research, the students stated that everything which makes things easier for us is technology and things would be very hard without technology. Simon (1983) defines technology as a discipline designed by humankind to have an edge over nature by using science. Technology is the transformation of nature in accordance with humankind's demands and requirements (ITEA, 2007; NRC, 1996). Perrin (2012) defined technology as a system shaped by people using the surroundings and nature to achieve a goal or solve a problem. As for the definitions of technology made in the related literature, concept of technology can be described as a system that helps people overcome the challenges in their lives with the use of scientific knowledge. As far as the definitions of technology made by the students in the research are concerned, their perceptions of technology coincide with several definitions in the literature. Hence, it can be argued that the students are aware of technology's purpose of existence.

The student who participated in the research are called digital natives in the literature and they are individuals who did not meet technology later but were born into it. Prensky (2001) used the name digital native for children who are born into and raised amid new technologies. For digital natives, technology is the focal point of their lives and affects not only their activities in life but also their learning (Prensky, 2001).

Both advancements in digital technologies and presence of technologies such as computers, etc. at home and developments in Internet have caused changes in the understanding of school and student. Generation of digital natives have the competency to access and information they need on any subjects compared to previous generations (Kleiman, 2004). Bilgiç, Duman & Seferoğlu (2011) stated that digital natives are more inclined to learning. In this context, characteristics of digital natives are of importance to achieve goals and objectives of educational-instructional activities in a successful manner. So, proper use and perception of technology by children of this generation is required to raise qualified individuals who are most needed by any country. Consequently, it is critical to have opinion on students' perception of technology for proper guidance and efficient use of technology due to the need for individuals who are responsible for their own learning and are life-long learners.

RECOMMENDATIONS

In addition to this research, long-term vertical studies can be carried out on preschool and primary school students' use of technology. It can be ensured that parents are included in the studies performed with younger students. Qualitative studies can also be conducted to identify technological perception of students from different socio-economic and socio-cultural backgrounds. In accordance with the results of this research, students can be provided with informative trainings in how they can use technology more efficiently.

REFERENCES

- Aydın, F. (2010). Ortaöğretim Öğrencilerinin Coğrafya Kavramına İlişkin Sahip Oldukları Metaforlar. *Kuram ve Uygulamada Eğitim Bilimleri (EducationalSciences: Theory&Practice)*, 10(3), 1293-1322.
- Aydın, F. (2011). İlköğretim 6, 7 ve 8. sınıf öğrencilerinin teknolojiye yönelik düşüncelerinin çizimle belirlenmesi. *International Conference on New Trends in Education and Their Implications*. 27-29 April, Antalya, Turkey.
- Batur, Z, & Uygun, K. (2012). İki neslin bir kavram algısı: teknoloji. *Uşak Üniversitesi Sosyal Bilimler Dergisi*, 5(1), 74-88.
- Belet, Y. D. & Türkkkan, B. (2007). İlköğretim öğrencilerinin yazılı anlatım ve resimsel ifadelerinde algı ve gözlemlerini ifade biçimleri (Avrupa Birliği örneği). VI. Ulusal Sınıf Öğretmenliği Eğitimi Sempozyumu. 270-278.
- Bilgiç, H. G., Duman, D., & Seferoğlu, S. S. (2011). Dijital yerlilerin özellikleri ve çevrim içi ortamların tasarlanmasındaki etkileri. *Akademik Bilişim*, 2(4), 1-7.
- Creswell, J.W. (1998) *Qualitative Inquiry and research design: Choosing among five traditions*. Thousand Oaks, CA: Sage Publications
- Çapan, E.B., (2010). Öğretmen Adaylarının Üstün Yetenekli Öğrencilere İlişkin Metaforik Algıları. *Uluslararası Sosyal Araştırmalar Dergisi*, 3(12): 140-154.

- DeVore, P. W. (1980). *Technology: An Introduction*. Davis Publications, Massachusetts.
- Durukan, Ü., Hacıoğlu, Y , & Dönmez Usta, N. (2016). Bilgisayar ve Öğretim Teknolojileri Öğretmeni Adaylarının “Teknoloji” Algıları. *Bilgisayar ve Eğitim Araştırmaları Dergisi*. 4 (7), 24-46.
- Erişti, S. D., & Kurt, A. A. (2011). Elementary school students’ perceptions of technology in their pictorial representations. *Turkish Online Journal of Qualitative Inquiry*, 2(1), 24-37.
- Fidan, M. (2014). Öğretmen adaylarının teknoloji ve sosyal ağ kavramlarına ilişkin metaforik algıları. *The Journal of Academic Social Science Studies International Journal of Social Science* . 25 (1) , 483-496.
- Hansen, R., & Froelich, M. (1994). Defining technology and technological education: A crisis, or cause for celebration?. *International Journal of Technology and Design Education*, 4(2), 179-207.
- Hayden, M. A.(1990). Learning Environments for Technological Literacy, Proceedings of the Technology Education Symposium XII:Technology Education: The Teaching and Learning Environment, New Britain, CT.
- Herdem, K., Aygün, H. A., & Çinici, A. (2014). Sekizinci sınıf öğrencilerinin teknoloji algılarının çizdikleri karikatürler yoluyla incelenmesi. *Amasya Üniversitesi Eğitim Fakültesi Dergisi*, 3(2), 232-258.
- International Technology Education Association (ITEA). (2007). *Standards for technological literacy: Content for the study of technology*. Reston, VA: Author.
- Jarvis, T., & Rennie, L. J. (1998). Factors that influence children's developing perceptions of technology. *International Journal of Technology and Design Education*, 8(3), 261-279.
- Kalonde, G., & Mousa, R. (2016). Technology Familiarization to Preservice Teachers: Factors that Influence Teacher Educators’ Technology Decisions. *Journal of Educational Technology Systems*, 45(2), 236-255.
- Karabulut, B. (2015). Bilgi toplumu çağında dijital yerliler, göçmenler ve melezler. *Pamukkale Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, (21), 11-23.
- Kärkkäinen, S., & Keinonen, T. (2010). Primary School Teacher Students'perceptions Of Technology. *Problems of Education in the 21st Century*, 19.
- Khasawneh, O. Y. (2018). Technophobia: Examining its hidden factors and defining it. *Technology*, 13, 60.
- Kleiman, G.M. (2004). Myths and realities about technology in K-12 schools: Five years later. *Contemporary Issues in Technology and Teacher Education*, 4(2), 248-253.
- Li, G., & Ni, X. (2011). Primary EFL teachers’ technology use in China: Patterns and perceptions. *RELJ Journal*, 42(1), 69-85.
- Lim, C. P., Zhao, Y., Tondeur, J., Chai, C. S., & Chin-Chung, T. (2013). Bridging the gap: Technology trends and use of technology in schools. *Journal of Educational Technology & Society*, 16(2).
- Locatis, C. N. (1987). Notes on the nature of technology. *Educational technology*, 27(9), 13-16.

- McRobbie, C. J., Ginns, I. S., & Stein, S. J. (2000). Preservice primary teachers' thinking about technology and technology education. *International Journal of Technology and Design Education*, 10(1), 81-101.
- Miles, M. B., Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook*. sage.
- Mundy, M. A., Kupczynski, L., & Kee, R. (2012). Teacher's perceptions of technology use in the schools. *Sage Open*, 2(1), 2158244012440813.
- National Research Council. (1996). *The national science education standards*. Washington, DC: National Academy.
- Özata-Yücel, E. & Özkan, M. (2014). Fen Bilimleri Öğretmen Adaylarının Çevre Algılarının Kelime İlişkilendirme Aracılığıyla Belirlenmesi, *e-International Journal of Educational Research*, 5(4), 41-56.
- Özdemir, O. (2010). Fen ve teknoloji öğretmen adaylarının fen okuryazarlığının durumu. *Türk Fen eğitimi Dergisi*, 7(3), 42-56.
- Patton, M.Q. (2002). *Qualitative Research & Evaluation Methods*. 3 Edition. Sage Publications. London.
- Payne, P. (1996). Technology, phenomenology and educational inquiry. *The Australian Educational Researcher*, 23(3), 81-95.
- Perrin, D. G. (2012). Technological Revolution in Education – Part 5. *International Journal of Instructional Technology and Distance Learning*, 9(1), 1-3.
- Pierce, R., & Ball, L. (2009). Perceptions that may affect teachers' intention to use technology in secondary mathematics classes. *Educational Studies in Mathematics*, 71(3), 299-317.
- Pierce, R., & Stacey, K. (2013). Teaching with new technology: four 'early majority' teachers. *Journal of Mathematics Teacher Education*, 16(5), 323-347.
- Prensky, M. (2001). Digital natives, digital immigrants. [Çevrim-içi: [http://www.marcprensky.com/writing/Prensky %20-%20Digital%20Natives,%20Digital%20Immigrants%20-%20Part1.pdf](http://www.marcprensky.com/writing/Prensky%20-%20Digital%20Natives,%20Digital%20Immigrants%20-%20Part1.pdf)], Erişim tarihi: 12.09.2018.
- Pytlik, E. C., Lauda, D. P., & Johnson, D. L. (1978). *Technology, change, and society*. Worcester, Davis Publications.
- Shuell, T. J., & Farber, S. L. (2001). Students' perceptions of technology use in college courses. *Journal of Educational Computing Research*, 24(2), 119-138.
- Sidawi, M. M. (2009). Teaching science through designing technology. *International Journal of Technology and Design Education*, 19(3), 269-287.
- Simon, Y. R. (1983). Pursuit of happiness and lust for power in technological society. In C. Mitcham & R. Mackey (Eds.), *Philosophy and technology* (pp.171-186). New York: Free Pres.

- Solomonidou, C., & Tassios, A. (2007). A phenomenographic study of Greek primary school students' representations concerning technology in daily life. *International Journal of Technology and Design Education*, 17(2), 113-133.
- Staudenmaier, J. M. (1985). *Technology's storytellers: Reweaving the human fabric* (No. 306.46 St2988t Ej. 1 003056). MIT Press.
- Sunny, S., Patrick, L., & Rob, L. (2018). Impact of cultural values on technology acceptance and technology readiness. *International Journal of Hospitality Management*. In Press
- Şenel, A. ve Gençoğlu, S. (2003). Küreselleşen Dünyada Teknoloji Eğitimi. *Gazi Üniversitesi Endüstriyel Sanatlar Eğitim Fakültesi Dergisi*, 11(12), 45-65.
- Yıldırım, A. ve H. Şimşek (2006). *Sosyal Bilimlerde Nitel Araştırma Yöntemleri*. Ankara, Seçkin Yayıncılık.