Elementary School Students' Perceptions of Technology in their Pictorial Representations

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Abstract

The current study aimed to reveal elementary school students' perceptions of technology through their pictorial representations and their written expressions based on their pictorial representations. Content analysis based on the qualitative research method along with art-based inquiry was applied. The "coding system for the concepts revealed from the research data" was implemented. Visual language used in pictorial representations produce messages, with its specialized codes. The degree of students to understand and explain their perception on technology composes the visual codes in this research. The study carried out with fifth-grade elementary school students was applied to a class of 28 students. The elementary school students participating in the present study had diverse perceptions of today's technology, and most of their perceptions of technology were based on computer and electronic household appliances. Some students' perceptions of technology were based on the Internet and mobile device technologies. Their perceived future technology was observed as human-computer interaction in the area of computer technology. Findings were discussed followed by relevant implications.

Keywords: Art education; technology perception; pictorial representation

Introduction

Artistic activities and pictorial representations are among the effective factors that help students to express themselves in educational environments. Artistic studies and applications expected to develop children's cognitive as well as affective skills in the educational process are considered to help children freely express themselves in the educational processes. Artistic areas and pictorial representations both constitute a process that supports other teaching areas and provide an environment in which children can freely express themselves (Hudson & Hudson, 2001). Art education supports students' intuitiveness, their creativity, their ability to describe/define an event or a concept and their perceptive determination to establish communication (Arnstine, 1990; Efland 1995; Eisner 1991; Welch & Greene, 1995). Art education is a process that allows students discover, interpret and define their own culture (Clarke, 1996). For children, art is a way of expressing their culture and their knowledge. Art is not only a rich source that helps explain and transfer various cultural images but also a way of raising consciousness of cultural values and cultural identity (Boughton & Mason, 1999).

Pictorial representation is a criterion that helps recognize children in the psycho-pedagogical process. Pictorial representation is also important since it is a representation tool that allows reflecting children's intelligence, personality, qualifications and their inner world (Yavuzer, 1992). The drawing activity that occurs as an indicator of a child's creativity, perception and skills, and creativity is also considered as a determinant factor of affective and social education (Artut, 2002). Human has the ability to understand and interpret the world he or she lives in, and all individuals interpret and

express the world in a different way. A child who can express his or her feelings and thoughts about realities in the world with the help of a common tool for representation may not always express his or her feelings and thoughts about his or her inner world with the help of such language (Kırışoğlu, 2002). One of the most significant ways for children to interpret and express the world is drawing pictures (İlhan, 1997; Özkaya, 2007). For children, drawing a picture is a process of gathering different experiences in order to create a unique thing (Ersoy & Türkkan, 2009). Besides children's written expressions regarding their inner world, their pictorial representations of their inner world reflect how they perceive their environment, what their place is in this environment and how they understand the images they get from multiple stimulants. In other words, in their drawings, children organize and interpret their perceptions and observations regarding their environment; thus, they express their perceptions regarding the outer world (Belet & Türkkan, 2007).

It is seen in related literature that children's pictorial representations were studied in different subject areas. Some of these subjects were children's image of a scientist (Buldu, 2006; Oğuz, 2007; Türkmen, 2008), perception of the concept of health-doctor (Rijey & Van Rooy, 2007; Taş, Aslan & Sayek, 2006), perception of European Union (Belet & Türkkan, 2007), perception of environment (Barraza, 1999; King, 1995; Matthews, 1985), perception of violence (Yurtal & Artut, 2007), cultural perception (Belet & Erişti, 2010; Erişti & Belet, 2010), technological perception (Moore, 1987; Rennie & Jarvis, 1995), evidence for family lives (Türkkan, 2004) and family recognition (Doğru, Turcan, Aslı & Doğru, 2006).

Technology, with lexically means "systematic application of information in industrial operations", was defined by Rosh (1978) as a complex and abstract concept. Since complex and abstract concepts are difficult to understand without a certain level of intellectual maturity, children consider technology in different ways (Rennie & Jarvis, 1995). Parallel to the complexity of the concept, children from different age groups are likely to have different perceptions of technology. Determining how elementary school students use technology, how they perceive it and what their perceptions of technology use will be in future could provide directive information for understanding the concept of technology. In this respect, to determine children's perceptions of technology, it would be beneficial to use their pictorial representations that facilitate understanding their linguistic expressions as well as understanding what they fail to express verbally.

Activities including pictorial representations were used in this study since in the process of elementary school education, they are believed to be applications that provide data to better-analyze children's thoughts. Participating children were expected to reflect their pictorial performances and their technology perceptions in their pictorial representations. In their pictorial representations, they were also expected to reflect their thoughts about and attitudes towards future technologies objectively. In this regard, the basic purpose was to reveal elementary school students' perceptions of technology through their pictorial representations and their written expressions based on their pictorial representations. Depending on this purpose, the following research questions were addressed:

1. What are elementary school students' perceptions of the concept of technology?
2. What are elementary school students' perceptions of technology use in future?

Methods and Procedures

Research Design

Content analysis based on the qualitative research method and art-based inquiry pattern were applied in the current study. A majority of researchers examine various approaches in educational environments based on scientific data as well as on artistic data (Barone & Eisner, 1997; Cole & Knowles, 2001; Denzin & Lincoln, 2005). This allows researchers to examine a different conceptualization regarding how education functions, what it means and for what purpose an activity is carried out in the teaching/learning process (Finley, 2005). In this regard, art-based inquiry – one of the qualitative research pattern – was used in the process of the analysis of the drawings. Art-based inquiry is a pattern that relates art and research in scientific studies (Denzin & Lincoln, 2005). Art-based inquiry pattern uses applications as to literacy and visual arts and various methods for these

applications. Being an inter-textual pattern, art-based inquiry relates art and research efforts in scientific studies. The aim is to reveal students' perceptions and perspectives on various situations based on their own impressions and artistic representations. Art based inquiry helps reveal students' views about and perceptions of various situations based on their artistic representations and their own related impressions (Eisner, 2002).

Participants

The availability-sampling method was used to determine the school for the application. The study was carried out with fifth graders attending Ulku Elementary School, where the application was thought to be effectively and objectively carried out by the researchers.

The rationale for conducting the present study with fifth graders was that they tend to reflect their thoughts independently and freely and question realistic issues. In addition, their pictorial representations are more likely to include observation-examination based effects. The present study was carried out with a class of 28 fifth graders. The students' names were changed for confidentiality. The distribution of the students with respect to their gender is given in Table 1.

Table 1. Distribution of Students with Respect to their Gender

Gender	f	%
Female	17	39.3
Male	11	60.7
Total	28	100

Data Collection

The research data were collected via the participating students' drawings that were expected to reflect their perceptions of todays' and tomorrows' technology and via their written idea (documents) about what they depicted in their drawings. The features of the data collection tools and the data collection process could be summarized as follows: in order to determine elementary school students' perceptions of technology in their pictorial representations, first, the students were requested to draw a picture regarding what technology is and what technology would be in future. As the second data collection tool, the students were asked to write down what they wanted to depict in their drawings. Thus, the data collection process included different data collection tools (pictorial representation, written expressions based on pictorial representations); in this way, the reliability of the data collection process was increased. At the end of the application, the data obtained via the students' drawings as well as from their written expressions based on their drawings were analyzed through document analysis. The application was carried out in an environment including the art teacher and the researchers in the course of Fine Art Education in a period of two course-hours (40 minutes each).

Analysis and Interpretation of Data

Content analysis was applied for the analysis and interpretation of the interview data. The "coding system for the concepts revealed from the research data" – which is one of the coding methods in qualitative studies - was used (Yıldırım & Şimşek, 2006). The research data were analyzed by examining all the research data and determining the themes in line with the data examined, and then by relating these themes to the research data obtained. Thus, the research data were analyzed in two phases. First, the students' pictorial representations and their written expressions based on their pictorial representations were analysed. Then, depending on the findings obtained, the themes were determined, supported with direct quotations and interpreted. Pictorial representations play a central role in postmodernist scientific researches (Finley, 2005). Visual language used in pictorial representations produce messages, with its specialized codes (Arnheim, 1954). The degree of students to understand and explain their perception on technology composes the visual codes in this research. The visual codes were used for analysing the pictorial representations of the research. Pictorial representations in the research analysed along with three dimensions of visual language; the subject of representation, the functional use of the representation as visual language and the degree

of visual code. The pictorial representations include high degree of visual code through technology in today's world and technology tomorrow are mostly examined and explained data's for qualitative analysis. Visual language and visual codes are better highlighted the perception of the students during the analysis of data's of this research.

For the analysis of the data, a form was developed to examine the elementary school students' pictorial representations and their views about their pictorial representations; and a *researcher comment* part was included in the form and was filled out by the researchers. For the reliability of the study, the researchers and field experts examined the form and determined the items they agreed and disagreed on. The reliability formula suggested by Miles and Huberman (1994) was used, and the reliability of the study was found as 95 %.

<div align="center">Findings and Interpretations</div>

The findings obtained were gathered in two groups: "Students' perceptions of technology in their pictorial representations" and "Students' perceptions of technology in future". The findings obtained were tabulated as frequency distributions and summarized with the support of direct quotations from the participants' views.

Students' Perceptions of the Concept of Technology

In order to reveal students' perceptions of technology, they were asked to draw a picture depicting what technology was for them. In addition, the students were also requested to reply to a question regarding what they depicted in their drawings. The themes and sub-themes based on the students' pictorial representations of the concept of technology are presented in Table 2.

Table 2. Students' Perceptions of the Concept of Technology in their Pictorial Representations

Perceptions of technology in pictorial representations (N=28)	f
Computer Technology	**22**
Desktop Computer	*11*
Laptop Computer	*7*
Computer games	*3*
Projector	*1*
Internet Technology	**10**
Internet access	*5*
Search engines (Google, Mozilla Firefox)	*3*
Social Networks (Facebook)	*1*
Modem	*1*
Mobile Device Technology	**6**
Cell phones	*6*
Electronic household appliance technology	**11**
Television (with remote-control, LCD)	*8*
Refrigerator	*2*
Oven	*1*
Transportation Vehicle Technology	**1**
Car	*1*

As shown in Table 2, among all participants, 22 considered technology as '*computer technology*'; 10 of them as '*Internet technology*'; 6 of them as '*Mobile device technology*'; 11 of them '*Electronic household appliance*'; and only one of them considered technology as '*Transportation vehicle technology*'. Table 2 demonstrates that the technology-related perceptions of a majority of the participating students belonged to the themes of '*Computer technology*' and '*Internet technology*'.

Almost all students reported their views about their pictorial representations by relating and comparing the perception of today's technology with future technology.

A11, one of the students, reported her views about technology as '*I wanted to depict today's technological products, so I drew a cell phone. And as technology, I can count television, cell phone, laptop computer, refrigerator, car…*'.

A14, explained his pictorial representation saying '*As today's technology, I drew a computer and a car…*'.

A9 emphasized the sub-themes of '*electronic household appliance technology*' and '*mobile device technology*' saying '*As a current technology, what I like most is television, so I drew a TV set. Also, as technological devices, I like cell phones and ovens because you can cook very delicious meals in an oven…*'.

Another participant, A8, reported her views regarding the sub-theme of '*mobile device technology*' saying '*I drew a cell phone as today's technology. I can't imagine a life without mobile phones. Without my mobile phone, I wouldn't speak to my parents or relatives. What would happen if there weren't any mobile phones?*"*. Figure 1 depicts the drawings of the students A9 and A11 about today's technology.
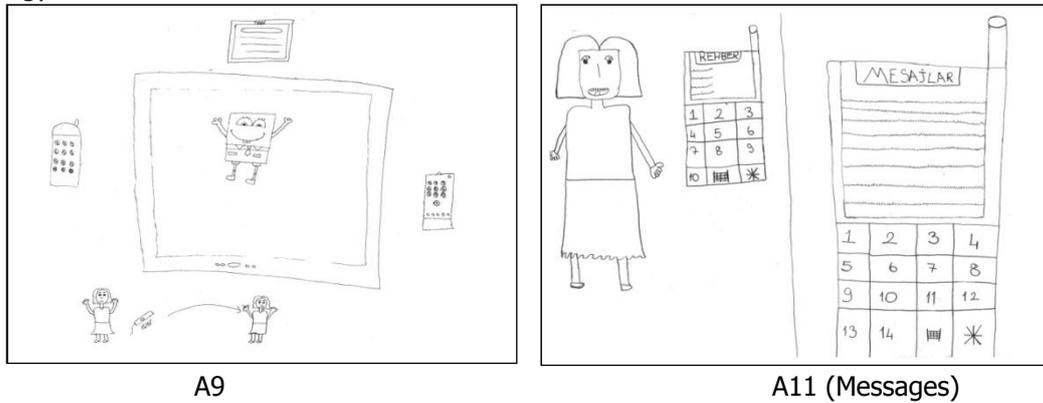

A9   A11 (Messages)

Figure1. Drawings of the students about Today's Technology

It was observed that the elementary school students' perceptions of technology covered the computer, Internet, mobile technologies and electric household appliances, respectively. It could be stated that the students mentioned these technologies as they used them most in their daily lives.

Students' Perceptions of the Concept of Future Technology

In order to reveal the students' perceptions of future technologies, they were asked to draw a picture regarding how technology would be in future. They were requested to respond to a question regarding what they depicted in their drawings. The themes and sub-themes based on the students' pictorial representations of future technologies are presented in Table 3.

Table 3. Students' Views about Their Perceptions of Future Technology

Students' Perceptions of Future Technology (N=28)	f
Interactive Computer Technology	**22**
Human computer interaction	*11*
User computer game interaction	*4*
Teleportation into computer	*3*
Virtual reality	*3*
Three-dimensional Interface	*1*
Interactive Internet Technology	**12**
User – internet interaction	*8*
User – search engines interaction (Google, Mozilla Firefox)	*3*
User – social networks interaction (Facebook)	*1*
Interactive Mobile Device Technology	**7**
Teleportation into cell phone	*7*
Interactive Electronic Household Appliance Technology	**6**
Interactive television (Television operating with voice prompt and Brain power controller)	*4*
Interactive refrigerator	*1*
Washing machine	*1*
Time Machine	**1**
Transportation Vehicle Technology	**1**
Car (Cars going in the sky, on the land or in the sea)	*1*

As shown in Table 3, a majority of the students explained future technology under sub-themes based on the main themes of '*Interactive Computer Technology'* and '*Interactive Internet Technology'*.

In her views about her pictorial representation, A2 mentioned the opportunity to interact with computers. Her views on the sub-theme of '*Human – computer interaction'* were as follows:

> '*I depicted future computers in my drawing. You cannot turn on this computer if you don't finish your homework first. This computer can talk to you, help with your homework and play with you… This computer is like a robot and can be very sweet when necessary'*.

A13 reported her views regarding the sub-theme of '*Human – computer interaction'* saying;

> '*The Computer does not allow children to turn it on before they finish their homework. Thus, with its hands, the computer checks if the child has finished his or her homework. If the homework is finished, then it allows the child to turn it on'*.

Figure 2 shows the pictorial representations of the students A2 and A13 about human-computer interaction.
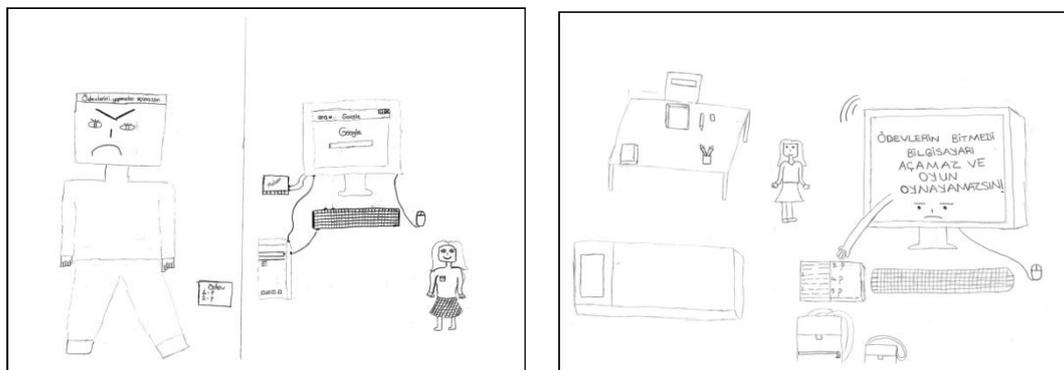
A2   A13
(You can not open without finish your homework) (if you don't finish your homeworks, you can not play game)

Figure 2. Drawings of the students about Human-Computer Interaction

A19, reported her views regarding the sub-theme of '*User – computer game interaction*'. Focusing on how computer games and computer – user interaction should be in future, A19 stated '*In future, I would like to enter a computer game in a computer*'.

Another student, A20, reported his views regarding the sub-theme of '*User – computer game interaction*' saying '*I can enter a computer game if technology advances more. As I can normally enter a computer game while administrating it, other players can administrate the game me too…*'.

A1 reported her views regarding the sub-theme of '*Teleportation via computer*' and '*Three-dimensional computer*' saying;

> '*…the monitors and keyboards of old computers were too small. But, in future, they could be designed bigger. Also, they can allow the person to enter inside the computer game via teleportation. And also, laptop and desktop computers can be touch-operated. Future computers can also be three-dimensional*'.

The drawings of the two students about teleportation via computer and tree dimentional computer can be seen in Figure 3.

A20
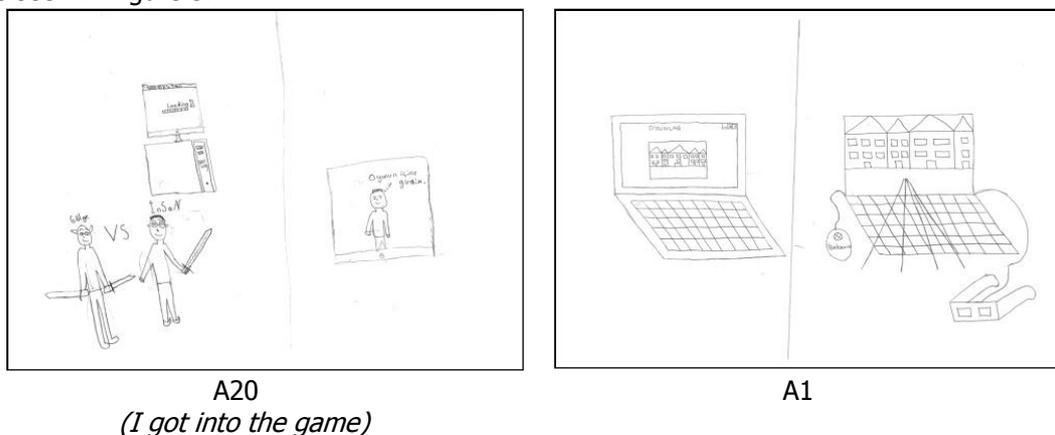*(I got into the game)*

A1

Figure 3. Drawings of the students about Teleportation via Computer and
Tree Dimentional Computer

Regarding the sub-theme of '*virtual reality*', A10 mentioned a computer technology that could allow users to feel themselves as if they were in real world saying;

> '*Thanks to computers in future, you can feel as if you are in the game with the help of special glasses. These glasses can be designed in a way to hurt you when you crash into someone else in the game. When you put off the glasses, you will turn to this real world*'.

Regarding the sub-themes of '*User – internet interaction*' and '*User – search engines interaction*', A7 stated;

> '*Now, we only see the pictures in computers and on the Internet, but in future, we will travel to the places in the pictures; well, this is a kind of teleportation. Teleportation into the pictures, or into the places in the pictures via the search engine of mozilla firefox …*'.

Another student, A23, reported his views regarding the sub-theme of '*user–internet interaction*' saying '*…you can enter the Internet. You can play and watch games in the internet…*'. A5, another student, emphasized the speed of the internet connection saying '*We spend all out lives waiting for something. But in future, we won't wait for anything because the internet connection will be faster…*'.

The Figure 4 depicts the drawings of the students A10 and A7 about user-Internet interaction.

A10   A7
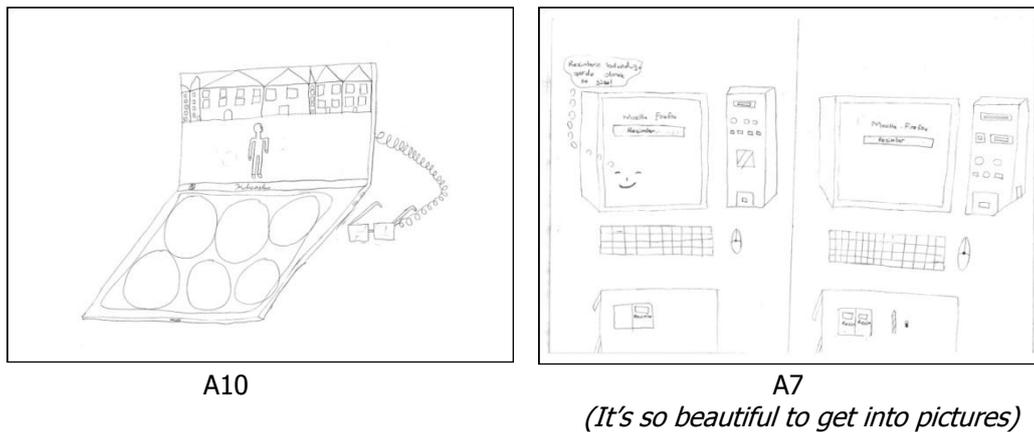   *(It's so beautiful to get into pictures)*

Figure 4. Drawings of the students about User-Internet Interaction

Regarding the theme of '*User – social networks interaction*', A18 stated '*In future, computer technology will allow you to enter into Facebook …*'.

A11, reported her views regarding the sub-theme of '*Teleportation via cell phone*' under the main theme of '*Interactive mobile device technology*' saying '*With advances in technology, when you touch the phone, you will go to where you have touched*'.

A27 reported her views regarding the main theme of '*mobile device technology*' saying '*Today, mobile phones can send voice, but in future, we will talk to each other via teleportation…*'.

A3 reported her views regarding the main theme of '*mobile device technology*' saying '*In this drawing, I depicted teleportation by drawing a cell phone that allows sending animated images via teleportation …*'.

The Figure 5 shows the drawings of the students A18 and A27 about user-Internet interaction.

A18   A27
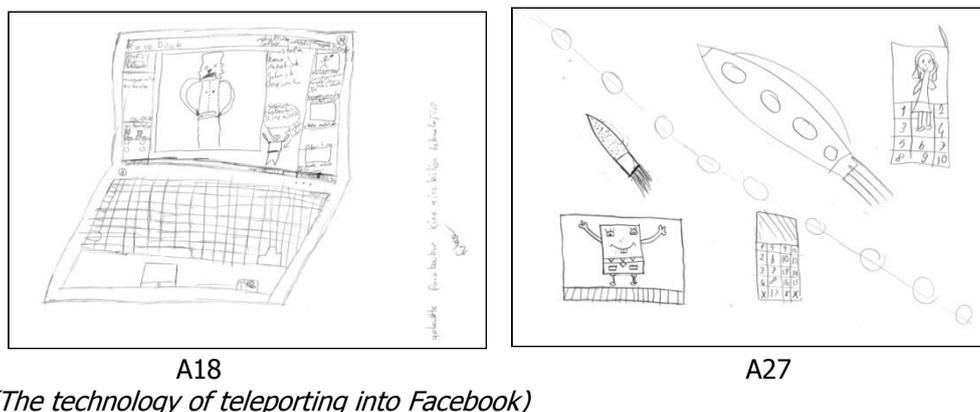*(The technology of teleporting into Facebook)*

Figure 5. Drawings of the students about Mobile Device Technology

The students' pictorial representations and their related views regarding the theme of '*Interactive electronic household technology*' were as follows: One of the students, A11, considered voice-operated television as one of future technologies saying '*I wanted to depict today's technological products, and voice-operated television rather than remote-control television is just an example for a technological development in future…*'. A22, another student, reported her views saying:

> '*As future technology, I drew television that operates on the power of thought. This technology is a television that will operate based on the commands of the brain without using any remote-control unit. It has more than one channel. It has a three-dimensional screen, and you will be able to change the channel whenever you want. You will also be*

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able to go inside the television and watch whatever movie you like. Also, you will be able to use it as a cell phone whenever you like. And the sound system will be over 100…'.

The pictorial representation of the students A11 and A22 about user-Internet interaction can be seen in the Figure 6.

A11
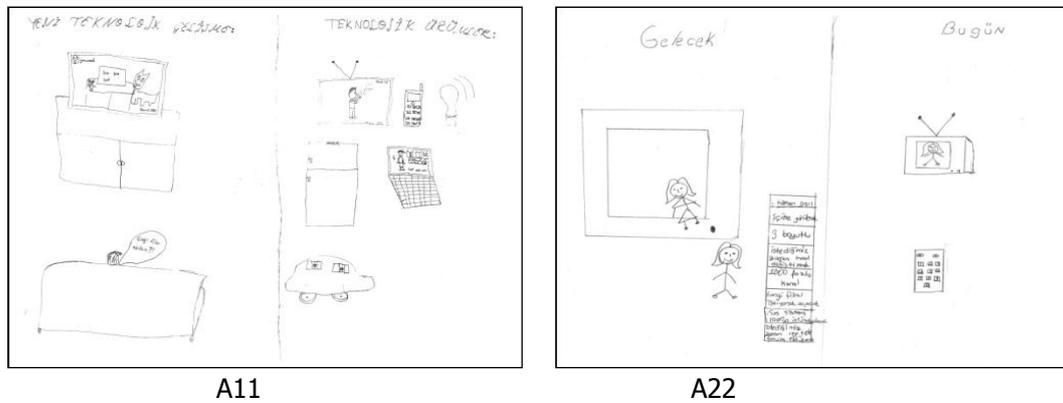
A22

(Open it, teleport into, three dimensional, change channel whenever I Want, channel more than a thousand, open which film I want, sound system, use as mobile-phone…)

Figure 6. Drawings of the students about Interactive Electronic Household Technology

One of the students, A27, considered a refrigerator as future technology that can interact with its user. A27 stated;

'I drew the current and future refrigerators. The refrigerator in my dream will facilitate the work of all people. It will ask "what do you want?". Then the door of the refrigerator will open and one of its shelves will serve us what we have wanted. It will also give us what we want to prepare'.

A24, another student, considers a '*Time Machine*' as future technology, which constituted another theme. A24 explained his drawing saying '*We get older for a year or more with the time machine…'.*

Another student, A14, reported his views regarding the theme of '*Transportation vehicles technology'* saying;

'With the developments in technology, cars will go in the sky, on the land and in the sea. With advances in technology, there will be a dual washing machine: one of them will wash the clothes and the other will dry them…'.
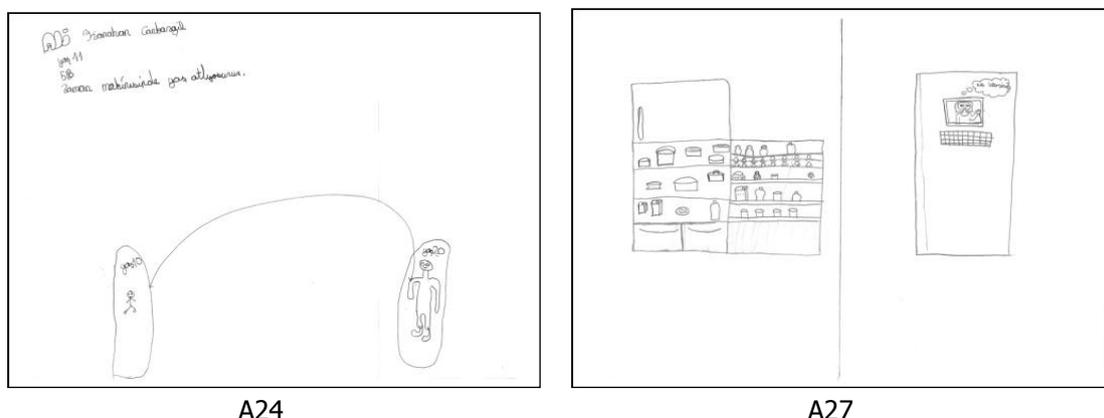
A24

(Age older-younger with time machine)

A27

Figure 7. Drawings of the students about Transportation Vehicles Technology

The Figure 7 depicts the pictorial representation of the students A24 and A27 about the transportation vehicles technology.

Among the elementary school students' views about their perceptions of the concept of future technology, those about interactive computers and Internet technologies took the first place. The students' views about human – computer – human interactions were determined.

Conclusion and Discussion

The elementary school students participating in the present study had diverse perceptions of today's technology, and most of their perceptions of technology were based on computer and electronic household appliances. Some students' perceptions of technology were based on the Internet and mobile device technologies. Similarly, in a study carried out by Rennie and Jarvis (1995), it was found out that in their drawings, younger students depicted their perceptions of technology by drawing mostly computer and electrical devices. The students' diverse perceptions revealed in the study were found to result from the fact that the students perceived the most-frequently used technological devices as technology. In other words, it could be stated that the students' perceptions of technology were related with the concepts which interested them most in their daily lives and which were most popular in their social environments. This finding obtained in the study is similar to the results of another study carried out by Erişti (2010) on popular cultural themes in elementary school students' pictorial representations. The students participating in the study conducted by Erişti (2010) emphasized mostly the 'desktop computer' and 'laptop computer' in their pictorial representations among the popular cultural themes prominent in their daily lives. The output of our perceptions reflected in our lives constitutes our life styles; therefore, based on this result, it could be said stated that the devices used by students in their daily lives shape their perceptions of technology. In addition, the finding that the students considered Internet technology as Internet access and research engines is parallel to the finding of another study carried out by Ersoy and Türkkan (2009) who reported that children depicted their perceptions of Internet as a source of information in their drawings. In the study conducted by Ersoy and Türkkan (2009), the Internet, which children used as a source of necessary information, was reflected in their drawings as "search=Google". Today, television, computer and Internet technology constitute the basis of a student's interaction with others and with their environment. Children are intensely and effectively interested in contents including the themes of Internet and computer technologies. This fact leads to the creation of the areas of digital interest, digital culture and digital competencies. Especially the games, interactions and applications in virtual environments are quickly adopted, consumed and renewed by the new generation. The developing technology, cheaper computers and the spread of computers directly influence the spread of the digital culture (Binark et al., 2009; Erişti, 2010).

The findings that related computer and Internet technologies with computer games are quite striking regarding the students' perceptions of the current and future technologies in the study. Alver and Gül (2005), in their study carried out with a thousand of students, reported that there was a serious change in children's thoughts of game. Today, most children prefer playing games on computer to playing games designed with social interactions.

In the study, it was found out that most of the students' perceived future technology as human-computer interaction in the area of computer technology. The students' views about their pictorial representations regarding the theme of human-computer interaction revealed that computers in future will not allow users to operate it if they have not finished their homework yet. This result could be said to be due to the fact that in our country, parents generally allow their children to use their computer after they finish their homework. Considering the fact that students at this age allocate most of their computer-use time to games (Orhan & Akkoyunlu, 2004; Ersoy & Yaşar, 2003; Giacquinta, Bauer & Ellsworth, 1993), it is inevitable for families to ask their children first to finish their homework before they use their computers. This situation was depicted by the children in their drawings as '*without first doing my homework, my parents do not allow me to use my* computer'. Students playing games on computers reported that similar to real life, they wanted to join the game and to feel the game as they did in real world. In other words, regarding the sub-themes of user-computer game interaction and virtual reality, the students mentioned technologies that would allow users to feel themselves as if

they were in a real world. Virtual reality is a simulation model which allows its participants to feel as if it were real and which allows interacting with a dynamic environment created by computers (Bayraktar & Kaleli, 2007). Today, virtual reality applications mostly used for entertainment purposes are also used in education. However, it was striking that although students at this age had not met virtual reality applications at school yet, they were able to express their feelings about it.

It was also striking that students at this age use social network sites – the number of which is increasing day by day though such sites have newly become a part of our lives – and that interaction in these sites should be increased. In addition, students' knowledge about such scientific issues as teleportation, time machine, human-technology interaction, virtual reality and power of thought could be considered as an indicator of the fact that they are aware of their environment as opposed to popular belief. Furthermore, the students mentioned such problems as heavy Internet traffic and slow Internet connection they experienced in real life and pointed out that technology should find a solution to such problems.

Considering the fact that students' perception qualities are formed mostly by the concepts they face, it could be stated that their selective perception is formed in line with their interests. The research finding pointing out the importance of technological interaction is similar to the findings of the research study carried out by Moore (1987). In his research Moore (1987) asked primary school students technology perception by draw a technologist at work and he found that these children placed emphasis on design, invention and making things, as well as using computers. In addition, children are intensely influenced by their environment. While interacting with their peers, they obtain information about well-known images in their environment more easily and do not have difficulty reflecting this information. Depending on the findings obtained in the study, it could be stated that students identify today's technology with well-known and interesting concepts found in their environment. As for future technology, students reflect well-known and interesting concepts - found in their environment – in their pictorial representations within the context of creative approaches. Artistic activities allow students to reveal their creative abilities and to express themselves as well as use their imagination. In addition, artistic activities refer to the transfer of observations, images, feelings and thoughts in the form of objective reality. In their drawings, children reflect what they see, know, learn and experience. Children's drawings allow concretizing their inner-worlds, their communication with the outer world and their problems or expectations (Hague, 2001). While it is impossible to learn about children's inner world in some circumstances, it is possible to learn about their inner world with the help of their pictorial representations (Cox, 1992). In this respect, in studies carried out with especially elementary school students, determining students' views via art provides researchers with the opportunity to obtain a convenient finding. The reason is that students can more concretely present pictorial representations and their views about their pictorial representations (Denzin & Lincoln, 2005; Eisner, 2002; Finley, 2005).

Following suggestions emerge in line with the findings:
- Comparative studies on the technology perceptions of students from different cultures could be carried out.
- Studies based on participatory observations in a longer process could be conducted to determine how students use technology and how this process changes their perceptions.
- Qualitative studies could be carried out to examine students' perceptions of technology more deeply.
- Qualitative studies could be designed depending on art-based inquiry, which allows elementary school students to express their thoughts concretely.

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