

Preservice Mathematics Teachers' Perceptions about Visually Impaired Persons*

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Abstract

The aim of this study is to determine what perceptions preservice mathematics teachers have about visually impaired persons and their environments. Seventy volunteer preservice mathematics teachers participated in the study. In this qualitative research, data were obtained through semi-structured interviews and “Draw a Visually Impaired Person and his/her Environment-DAVIPE” test. The results showed that perceptions of preservice mathematics teachers on visually impaired persons are in five different categories as outdoor environment, indoor environment, abstract environment, dark environment and aid-available environment. Besides, it was also determined that perceptions of preservice mathematics teachers on visually impaired persons have six different sources such as physical, emotional, sensorial, environmental, educational and mental. According to this, visually impaired persons are generally the people who can move freely with white canes, wear glasses, are happy, have improved auditory and tactual senses, and have easy lives with proper environmental arrangements, however, suffer from difficulties from insensitivities of other people, for whom accessible educational environments should be provided, and who have a rich dream world.

Keywords: visually impaired person, preservice mathematics teacher, perception, equity in education

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* The word “persons” is used to focus on a specific society.

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Introduction

Six basic principles for a qualified mathematics education were introduced in reform movements, which were started by the American National Council of Teachers of Mathematics [NCTM] in 1989 and have reached today: Equity, teaching program, teaching, learning, evaluation and technology. One of these, equity in education has increasingly become a common concern for practitioners and policy makers in the World (Herrera, Jones, & Rantala, 2006:7). Thus, the importance of education for every person is emphasized with some documents such as *Individuals with Disabilities Education Act* (IDEA, 2007) which were signed as The Education for All Handicapped Children Act in 1975 and were organized a few time, *Salamanca Statement* (UNESCO, 1994), *Principles and Standards for School Mathematics* (NCTM, 2000) and *No Children Left Behind Act* [NCLB] (2001). Today many students are struggling with mathematics and fail over and over again (PISA, 2015; TIMSS, 2016), and so, the importance of teachers and their teaching approaches and concern for equity, cannot be ignored. However, an equitable teaching is much more than providing students with an equal opportunity to learn mathematics. That is to say, it is not enough to take same mathematics course, do same homework and use same evaluation devices, because equal teaching means to encourage teachers to behave all students fair and objective with regarding the information obtained for students from different sources (Van De Walle, Karp & Bay-Williams, 2012). It can be guessed that impaired students may have to cope with more difficulties than even from students without any impairment. Therefore, the most possible large level, least restrictive environment, free of charge and proper education must be provided for impaired students (IDEA, 2007). Besides, whatever their personal characteristics, previous experiences or physical difficulties, all students must find opportunities to receive mathematics education and learn mathematics (NCTM, 2000:12).

Many countries such as Australia, Canada and USA support impaired persons' education through regulations and state policies and there are also detailed regulations for impaired persons' education in Turkey as well. *Basic National Education Act* (with number 1739) and *Special Education Services Regulation* are the most important ones. 37th article of *Regulation of special education services* (MEB, 2006) indicates the following:

“It is necessary that individuals who need special education should continue their education among their peers without disability through inclusive education; however, formal and non-formal educational schools and institutions at all types and levels are opened by the Ministry for these individuals”.

Besides, *Basic National Education Act* (with number 1739) indicates that all children have right to have education regardless of their disabilities. Visual impairment is one of the disabilities that individuals may face.

Visual impairment is defined in two different views as legal and educational. The legal definition is used by medical staffs to determine whether a Visually Impaired Person (VIP)³ can benefit from legal opportunities. According to this, blinds (total visually impaired) are persons with 20/200 or less visual acuity after all treatments and whose visual field is not more than twenty-degree angle. Moreover, partially sighted are persons with 20/70 and 20/200 visual acuity after all treatments (Howard, Williams & Lepper, 2010/2011:370). Most of the persons defined as legally blind can benefit from sight residual (without light perception, sensing light and shadow or counting fingers from 1 meter at most and sensing some colors). For that reason, first educational definitions are needed to show which sensory channel is used. From education point of view, a blind is a person with high degree visual acuity loss, and who learn through touching, i.e. using Braille alphabet, hearing and listening to talking books (MEB, 2008; Özyürek, 1995). In addition, partially sighted persons are individuals who can read written materials in normal or bigger font sizes with the help of glasses and magnifiers and besides, who need some environmental arrangements such as lighting, contrast

³ The author wants to emphasize that visually impaired person is a Very Important Person

(Özyürek, 1995). All these definitions show that VIPs belong to a heterogenic group differing from each other according to some characteristics such as functional vision, socio-economic situation, cultural background, the age virtual impairment occurred, existence of other disabilities and cognitive capability (Gürsel, 2013).

VIPs cannot benefit from their visual senses, and so they are disadvantaged because they have to learn concepts only by hearing, touching etc. As a matter of fact, visual impairment affects a person's development in other areas somehow and generally all dimensions of development are negatively affected by disabilities (Brian & Haegele, 2014; Lieberman, Houston-Wilson & Kozub, 2002). While mental functions of most of them are normal, their cognitive, social and language skills are negatively affected as they cannot receive and understand any visual information from their environment (Kizar, 2012). For that reason, they may face serious problems especially about area and space concepts. Even smiling for some VIPs cannot develop by itself like social reflections of sighted persons (Vaughn, Bos & Schumn, 2003). Therefore, VIPs can experience difficulties such as spending less time with their peers (Gürsel, 2013: 226), not feeling as a part of the society and feeling lonely (Çarkç1, 2011:47, İkiizoğlu, 2005). It is a known fact that in Turkey, visually impaired males can go out by themselves, but visually impaired females cannot because of physical and sexual violence (Arslan, Şahin, Gülnar & Şahbudak, 2014). Another difficulty is that VIPs may have difficulty in defining burnt smell and a crash voice with just looking at their origins and so they cannot act accordingly (Gürsel, 2013:225). VIPs can use the reflection of a voice through their hearing ability and know the distance and direction of the object; however, it may not be possible for them to know what the object is without touching it or asking information from other persons with direct experience (MEGEP, 2013:13). On the other hand, all concepts cannot be learned through touching and hearing. Especially abstract objects are difficult to learn for VIPs. Visual impairment which causes so many difficulties in learning-teaching process is a less-probable disability in comparison with other disabilities and its generality differs according to adopted definitions and ages. According to World Health Organization (WHO, 2017), there are 253 million people with visual impairment all over the world. Thirty-six million of these people are totally blind while 217 million have low vision. In Turkey, information for VIPs is given in accordance with *Survey on Problems and Expectations of Disabled People* performed by Turkish Statistics Institution (TUIK, 2010). According to this, 8.4% of 280014 impaired persons who have at least 20% disability ratio in their health reports, live in Turkish Republic and are registered in National Disability Data Base have visual impairment. Besides, 32.1% of VIPs are illiterate, 11.8% are literate without a diploma, 29% are primary school graduates, 12.5% have primary education/secondary school and equivalent education and 14.6% are high school and over graduates. These numbers may show that necessary attention is not paid to educate all VIPs. This may also be interpreted as that there are some gaps between the laws and applications on education of persons with special needs. One of the main reasons of this is the teacher factor (Allinder, 1994).

Teachers are the most important components of learning-teaching process since they configure learning-teaching process and they are responsible to prepare a rich learning environment for their students. Shulman (1986, 1987) emphasizes the basic knowledges a teacher should possess in his works. Shulman (1987) divided these basic knowledges into content knowledge, general pedagogic knowledge, educational program knowledge, pedagogic field knowledge, education system knowledge, educational targets, values, history and philosophy basic knowledge and students' characteristics knowledge. Although these are all important, teachers must determine the individual differences of their students and find out the needs of their students according to these differences. In accordance with this, in the scope of *General Proficiencies of Teaching Professional* published by Ministry of National Education (MEB, 2017) in Turkey, teachers should have some proficiency related to students' characteristics. According to this, teachers should associate the information about students' development and learning characteristics with teaching processes, prepare flexible teaching plans in accordance with their socio-cultural characteristics and individual differences of the students and construct teaching environments. Thus, teachers may apply equitable teaching approach to make their students with different characteristics reach the same target (Boaler & Staples, 2008). However, the mathematics uses so many drawings, graphs, diagrams, symbols, charts, and other illustrations to present content and relationships, these have been particularly challenging for VIP, and difficult for

many special education teachers who are unfamiliar with the content (Rule, Stefanich, Boody & Peiffer, 2011). Nevertheless, the achievement of VIP is directly affected by their teachers' teaching ability. Indeed, teachers of these students are not specially educated in this field in Turkey like in some other countries, they often have to use the "trial and error" method to find the best way of teaching as Kohanová (2008) referred. Besides, in schools for visually impaired and inclusive schools where the author made applications for her doctorate dissertation, she observed that VIPs could not have enough mathematics education (Horzum, 2013). Research shows that if the instruction is tailored to individual needs, any students can reach his/her cognitive potential in this process (Pritchard & Lamb, 2012; Spindler, 2006), because visual images and memories of VIP have astonishingly remarkable capacity (Bülbül, 2016; Haber, Haber, Levin, & Hollyfield, 1993; Kennedy, 1993; Landau, Gleitman, & Spelke, 1981; Landau, Spelke & Gleitman, 1984; Millar, 1985). In order to achieve this and design an appropriate learning environment for VIPs, it is important to determine the teachers' knowledge and perceptions as precondition which can affect the practice, because perceptions affect teaching approaches of teachers and how they handle the subjects (Hofer & Pintrich, 1997). In other words, mathematics teachers' perceptions may play either a facilitating or an inhibiting role in translating curriculum guidelines into the complex and daily reality of classroom teaching (Haynes, 1996). For that reason, determining the perceptions of preservice teachers who may teach mathematics to VIPs in future may give important clues about what kind of contents should be in undergraduate education (Johnson, 2001).

Perceptions are revealed in two ways, qualitative (e.g., interview) or quantitative (e.g., survey) techniques (Witcher, Onwuegbuzie & Minor, 2001). One of the qualitative techniques is drawings. Although drawings are limited with the abilities of individuals, especially children's skills to express themselves through pictures encourage researchers to use drawings as data collection tool (Mavers, 2003: 20). Vygotsky (1978) suggests that drawing is a pictorial language, allowing individual to find concrete visual means of representing their thoughts, much like its own form of speech. Considering the phrase "A picture is worth a thousand words", it can be thought that the findings obtained through the pictures show important indicators for researchers. Thus, many researchers have used the pictures obtained from drawings in their investigations (Akerson, 2016; Alerby, 2015; Burkitt, 2017; Burns-Nader, 2017; Hamama & Ronen, 2009; Hansen et al., 2017; Harrower, Thomas, Altman, 1975; Hertting & Alerby, 2009; Lev-Wiesel & Yosipov-Kaziav, 2005; Regev & Ronen, 2012; Tortop, Kandemir, Kaya & Demir, 2015; Villanen & Jonsson, 2013). After children's drawings, adults' drawings are also used (Akerson, 2016; Harrower et al., 1975; Lev-Wiesel & Yosipov-Kaziav, 2005; Regev & Ronen, 2012; Tortop et al., 2015). One of the most common techniques is *Drawing Human Figure*, and another one is drawings including environments (Akerson, 2016; Chambers, 1983; Hansen et al., 2017; Harrower et al., 1975; Lev-Wiesel & Yosipov-Kaziav, 2005; Mays et al., 2011; Regev & Ronen, 2012; Tortop et al., 2015; Villanen & Jonsson, 2013). In literature, preservice primary school teachers' perception about mathematics (Akerson, 2016), students' perception about mathematicians and their works (Picker & Berry, 2001; Rock & Shaw, 2000; Yazlık & Erdoğan, 2018) have been investigated. Besides, drawings are used in order to determine the perceptions in special education investigations. For example, Regev and Ronen (2012) asked Arabic and Israeli preservice special education teachers to draw about their professions. It was found that the preservice special education teachers exhibited images showing their positive attitudes about their own expertise. This shows that some special education teacher candidates have idealist approaches or point of views. Lev-Wiesel and Yosipov-Kaziav (2005) investigated how hearing-impaired adult individuals reflect hearing impairment in their drawings. Besides, perceptions of preservice teachers on mentally impaired persons were also investigated (Tortop et al., 2015). In this investigation it is determined that preservice teachers perceive mentally impaired people as individuals who are in need for others to survive, whose their social lives are restricted, who cannot fulfill some skills and who require special attention. However, any investigation about the perceptions of Preservice Mathematics Teachers (PMTs) on VIPs has not been met. The current study has an interdisciplinary position to determine the perceptions of PMTs about VIPs and the environments with VIPs. From this point of view, this study offers a unique advantage because the usage of the drawings reveals more than the perceptions depending on just the words (Regev & Ronen, 2012). In this sense, the following questions were investigated in the current study:

1. What are the perceptions of PMTs about the environments with VIPs?
2. What are the perceptions of PMTs about VIPs?

Method

Research Model

The purpose of this study is to gain insight into PMTs' perceptions about the VIPs and their environments. For this purpose, a qualitative research method influenced by phenomenology is conducted, because a phenomenological research provides a deep understanding of a phenomenon as experienced by several individuals (Creswell, 2007:62). In the studies where the phenomenology pattern used, it is aimed to determine individual perceptions or perspectives related to a certain phenomenon (Yıldırım & Şimşek, 2016) as in the literature (Tortop et al., 2015; Yazlık & Erdoğan, 2018).

Participants

The criterion sampling which is one of the purposeful samplings methods was used for the current study. In criterion sampling which is based on all situations meeting a series of criteria determined before, mentioned criterion or criteria can be formed by the researcher or any ready criteria list can be used (Yıldırım & Şimşek, 2016). The participants of the current study were 70 PMTs studying in mathematics teaching department of a university in a big city in Turkey. Thirty-five of these participants were sophomore PMTs in 2015-2016 and the other thirty-five were sophomore PMTs in 2016-2017 academic year. The reason of this difference in academic years is that consistent results were wanted through participants with different backgrounds. The main criteria while choosing the participants were that they were taking Teaching Technologies and Material Design course in second year, and they were not taking Special Education course and they were volunteers. In Teaching Technologies and Material Design course PMTs were required to design mathematics-teaching materials for VIPs as for their final papers. This practice is of special interest to the researcher. In fact, preservice mathematics teachers does not have to design the materials for visually impaired students and all preservice teachers have to take special education course in Turkey. Before participants have this practice, first their perceptions about VIPs should be known. It was decided that information about VIPs should be given in future processes of this course in determined perceptions. But PMTs who took Special Education course and have theoretical knowledge about VIPs were not involved in participants. Thus, teachers' perceptions about the education of individuals with special needs are increased positively with the increase in the number of lessons they receive in the field of special education (Bender, Vail & Scott, 1995; Johnson, 2001) and knowledge and experiences of individuals on any specific concept affect their later concept knowledge and even their teaching the students (Ball, 1988; Vinner & Dreyfus, 1989). Since information about VIPs would be given in Special Education course, the researcher did not want to direct the participants. In Turkey, Special Education course generally includes inclusive education, family education, evaluation of individuals with special needs, developing individualized education programs etc. topics. Besides, topics such as definitions and characteristics of individuals with mental disability, visual disability, hearing disability, language-speech disability, emotional-behavior disability, learning disability, definitions and characteristics of gifted individuals included in the program. Finally preservice mathematics teachers' names are not used, but instead S1, S2, ..., S70 pseudonyms are used.

Data collection and analysis

In the current study, drawings as main data source and semi-structured interviews as supporting data source were used in order to determine the perceptions of PMTs on VIPs and their environments. Drawings of PMTs were obtained with the question "*Draw A Visually Impaired Person*

and his/her Environment-DAVIPE” which is adopted from “*Draw A Scientist Test-DAST*” developed by Chambers (1983). PMTs were asked to make drawing clearly and without any anxiety such as being in examination and there was no time limitation. Besides, the PMTs are reminded that their drawing skills were not evaluated, and so they should draw freely. During the study no sample to direct the PMTs was given and the PMTs were asked to reflect only their own thoughts. It was ensured that the collected data reflected the actual situation. In addition to this, they were asked to write their names on their drawing papers because interviews based on their drawings would be held later. After the coding of the drawings, 10-minute semi-structured interviews were conducted by the researcher with 20 PMTs who were thought to give remarkable answers and whose drawings had some difficulties to express the emphasized perceptions. In these interviews PMTs were asked what they intended to emphasize in their drawings about VIPs and to express their drawings.

Before data analysis the data obtained through drawings and semi-structured interviews were numbered as S1, S2, ..., S70 regarding the names. While doing this, each document and interview record also have the same number with each participant. In this respect, it was aimed that the researcher could easily see the relations between the data types (drawings as a document and the interviews afterwards), and the ground for the control of the validity and reliability of the data analysis was prepared. In this context, the data analysis conducted through content analysis. In content analysis, the aim is to form a frame for interpretation of the obtained raw data and to make it concrete in codes and categories after the determined situation becomes clear (Patton, 2002). After numbering process, constant comparisons were made to form common categories after first categorizing and sub-categorizing the environments handled in drawings and later perceptions about VIPs. Regarding the frequencies of these determined categories, each category was grouped in itself and put into table. Then, the analysis of the interviews was added to categories. During this process, VIPs’ facial expression (Akerson, 2016; Burkitt, 2017), behaviour (Harrower et al., 1975) and her/his environment (Hertting & Alerby, 2009), and the locations of the objects around VIPs or behaviours were taken into account. So, DAVIPE evaluations were covered under two sections: VIP and Environment. At the end of content analysis, the “VIP” section divided into six subsections that focus on the sources affected such as physical (free behavior skill, gender, glasses), emotional (happy, uneasy/anxious, neutral), sensorial (hearing, touching, smelling, tasting), environmental (environmental arrangements, social behaviour, dangers), educational (accessible educational environments) and mental (fantasy world, estimation ability). The second section, “Environment,” was divided into five subsections such as outdoor environment (park, road, pavement, yellow strips etc.), indoor environment, (classroom, house, room etc.), abstract environment, dark environment and aid-available environment.

Reliability and Validity

Some precautions were taken to increase the validity and reliability of the study. So, in order to increase internal validity of the study, the relations between categories obtained from the data and sub-categories of them and the relations between each category with other categories was controlled. Besides, the data analysis process mentioned above was repeated in different periods of times (approximately six months after the first coding) by the researcher. In both coding processes, the points of ‘agreement’ and ‘disagreement’ were discussed with the second researcher and necessary changes were made with two psychologists to interpret the perceptions in the drawings. Then, the results of the first coding and the second coding were united and consistency percentage was calculated using the formula $\text{Reliable} = \frac{\text{Agreement}}{\text{Agreement} + \text{Disagreement}}$ suggested by Miles and Huberman (1994). After this process, 93% agreement was achieved. For uncompromising data, the data analysis was finalized by taking the opinions of another researcher who has PhD in mathematics education. In order to increase external reliability of the study, all the processes of the study were detailed and supported with the quotations of the PMTs. In order to increase internal reliability of the study, findings were presented directly without any interpretation.

Findings

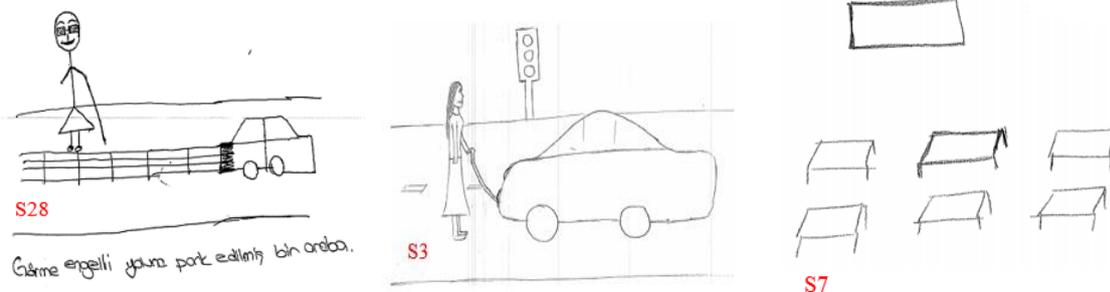
The perceptions of PMTs about the environments with VIPs

According to the drawings of the PMTs, the first perceptions were those related to the environments with VIPs. These perceptions were handled by the PMTs in five different environments such as indoor, outdoor, abstract, dark and aid-available (Table 1).

Table 1. The perceptions of PMTs about the environments withVIPs

Environments with VIPs		f	%
Outdoor environment	Walking near a road/on pavement	18	25.7
	Walking on yellow strips	17	24.3
	Crossing the street at traffic lights	9	12.9
	Dreaming/thinking	8	11.4
	Walking in the middle of a road	5	7.1
	Sitting in a park	5	7.1
Indoor environment	Classroom	5	7.1
	Room	3	4.3
	Stairs	1	1.4
Abstract environment		8	11.4
Dark environment		7	10
Aid-available environment		7	10

According to Table 1, most of the PMTs drew VIPs out of buildings - that is, outdoor environment. Thus, PMTs drew VIPs as walking near a road or on pavement most (25.7%), on embossed yellow strips (24.3%) and as crossing the road at traffic lights (12.9%). Besides, PMTs draw VIPs as dreaming-thinking (11.4%), as walking in the middle of a road (7.1%) and as sitting in a park (7.1%). The second environment PMTs mentioned was in a bulding -that is, indoor environment. According to this, VIPs were drawn in classroom environment (7.1%), in a room (4.3%) and on stairs (1.4%). The third environment PMTs mentioned about VIPs was the abstract environment (11.4%) where there is no open or closed environment and where the images which cannot exist in real world take place (Figure 5-S14, Figure 7-S58). The fourth environment PMTs mentioned was the dark environments (10%) where VIPs cannot see any object and where there is even no light perception. And finally the fifth environment PMTs mentioned was the environment where VIPs need help or where the society does not remain insensitive to them even if they do not need help (10%). Most of these environments indicated that VIPs need help while crossing the street at traffic lights, and only two of them indicated that VIPs need help always. Some drawings of PMTs about the environments of VIPs can be found in Figure 1.



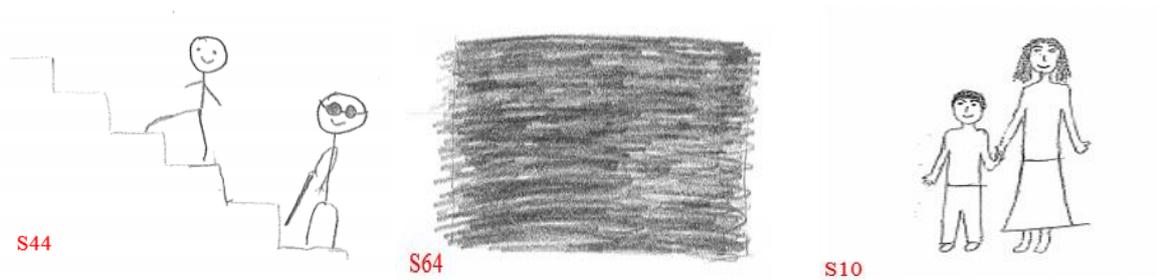


Figure 1. A few examples for the environments with VIPs

The perceptions of PMTs about VIPs

The second perception investigated in drawings of PMTs were the perceptions related to VIPs. These perceptions were affected by six different sources such as physical, emotional, sensorial, environmental, educational and mental respectively (Table 2).

Table 2. The perceptions of PMTs about VIPs

Source	Perceptions	f	%
Physical	Independent mobility	53	75.7
	<i>Without any support</i>	6	8.5
	<i>With a white cane</i>	45	64.3
	<i>With a white cane and a guide dog</i>	2	2.9
	Not able to move freely	2	2.9
	Gender	64	91.4
	<i>Female</i>	16	22.9
	<i>Male</i>	51	72.9
	Glasses	30	42.9
	<i>Black glasses</i>	23	32.9
<i>Not black glasses</i>	7	10	
Emotional	Happy	39	55.7
	Uneasy/Anxious	9	12.9
	Neutral	21	30
Sensorial	Developed sense of hearing	11	15.7
	Developed sense of touching/feeling	12	17.1
	Developed sense of smelling	3	4.3
	Developed sense of tasting	3	4.3
Environmental	Life becoming easy with environmental arrangements	24	34.3
	Excluded from the society	9	12.9
	Having difficulties because of humans insensitivity	13	18.6
	Accepted by the society	10	14.3
	Open to dangers	12	17.1
Educational	In need of accessible educational environments	9	12.9
Mental	Having a rich fantasy world	8	11.4
	Having poor fantasy world	3	4.3
	Estimation ability	2	2.9

As it can be seen in Table 2, the category where PMTs focused most about VIPs was the perception related to physical characteristics. This category shows that PMTs focus on whether VIPs can move freely, whether they use glasses and on their gender. According to this, 75.7% of PMTs emphasized that VIPs have the ability of being able to move freely. However, some PMTs pictured this ability to move freely as without any support (8.5%), most of them pictured it with a white cane (64.3%) and some pictured with both a white cane and a guide dog (2.9%). S43 mentioned that VIPs

can move freely with a white cane and she suggested that these white canes should have navigation on them to be more effective, and so, VIPs can move better. On the other hand, and only two of them indicated that VIPs do not have the ability to move freely and need help of others always. Besides, 42.9% of PMTs drew glasses on VIPs. In these drawing PMTs used black (32.9%) and not black (10%) glasses. And finally, most of the PMTs (91.4%) drew pictures indicating gender such as long hair, skirts for females and short hair for males. Only three of the PMTs who emphasized gender in their drawings drew both female and male VIPs, and 22.9% of them drew females (Figure 1-S10,S28, Figure 2-S26,S34) and 72.9% drew males (Figure 2-S8,Ö15,S32,S37).

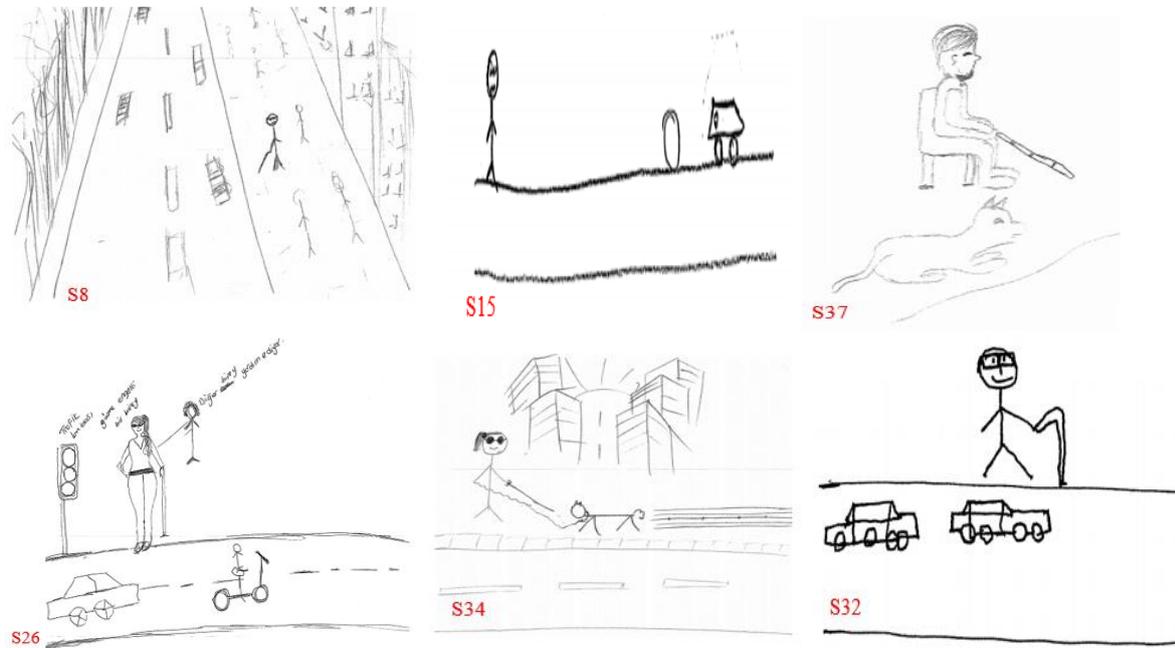


Figure 2. Some of the drawings based on physical characteristics

The second perceptions of PMTs related to VIPs were the perceptions based on emotions of VIPs. This category was classified as happy, uneasy-anxious and neutral. More than half of the PMTs (55.7%) thought that VIPs are content with their lives. 30% of PMTs drew VIPs as neutral without indicating any positive or negative emotion. But on the other hand, 12.9% of PMTs indicated that VIPs are not satisfy with their lives and are uneasy-anxious while moving. For example; S48 drew the anxiety of a VIP when she comes to the door to go out, S51 drew a VIP walking on yellow strips as neutral and S61 drew a VIP as happy (see Figure 3).

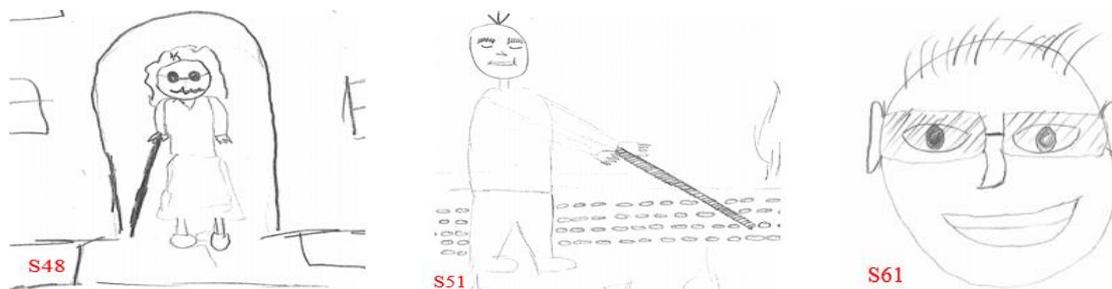


Figure 3. Some of the drawings based on emotions

The third perceptions of PMTs about VIPs were the perceptions based on sensorial perceptions. According to this, PMTs focused on senses of touching/feeling (17.1%), hearing (15.7%),

smelling (4.3%) and tasting (4.3%). As it can be seen in Figure 4, S4 indicated the developed sense of touching of a VIP through drawing big hands and developed sense of hearing through drawing big ears. S39 used the sense of seeing when a person with sight on the right saying ‘Look at the flower how wonderful and colorful’ in his drawing. However in the same drawing, the VIP on the left used senses of smelling and touching with his expression ‘How wonderful it smells, it must symbolize the coming spring. Its tissue is so soft and delicate’. On the other hand, S47 emphasized the struggle of VIP to know the world through the sense of tasting while VIP on the right in her drawing using the question ‘What kind of a thing a flower is? Can it be eaten?’ when the student on the left with sight reacts as ‘What a wonderful flower’.

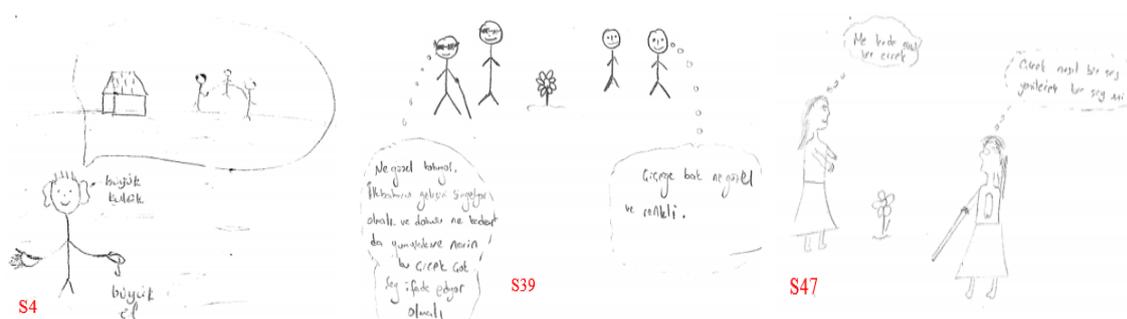


Figure 4. Some of the drawings based on senses

The fourth perceptions of PMTs about VIPs were the perceptions based on environment. Perceptions of PMTs originating from environment were shaped by both positive and negative points of views. PMTs with positive points of views drew pictures to emphasize that environmental arrangements facilitate the lives of VIPs (34.3%) and they are accepted by the society (14.3%). But PMTs with negative points of views drew pictures to show that VIPs are excluded from the society (12.9%), have difficulties because of insensitivities of others (18.6%) and are open to dangers (17.1%). As it can be seen in Figure 5, S20 drew that the embossed yellow strips on pavements make VIPs move more freely, and so, they facilitate their lives. Besides, S20 drew that yellow strips are only used by VIPs and other individuals with sight walk on their own ways, and this is interpreted as VIPs are accepted by the society. S57 drew a voiced bus stop system in which VIPs could understand which buses would arrive and when. S3 who is one of the PMTs with negative point of view emphasized the insensitivity of humans and the dangers in environment, and drew a VIP who is rescued from a car accident at the last moment. S11 showed that VIPs are excluded from the society and have difficulties because of insensitivities of the others. Similarly, S14 drew that VIPs are excluded from the society and S24 indicated that they are in jeopardy.



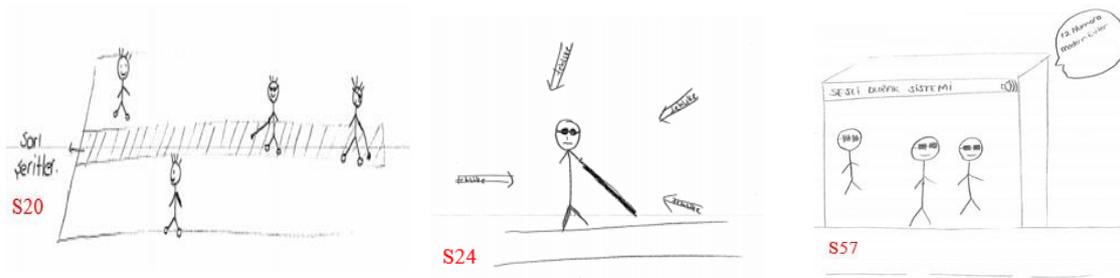


Figure 5. Some of the drawings based on environmental perceptions

The fifth perceptions of PMTs about VIPs were the perceptions based on education (12.9%). In this category PMTs pictured necessary accessible education environments for VIPs and the types of designs and even sample mathematics teaching environments (Figure 6). Accordingly, only three of PMTs paid attention to the books written with Braille, and other six paid attention to the arrangements in classroom environments. For example, S60 mentioned about reflecting the writings and visuals on the blackboard through the system established on the desks of visually impaired students. S62 indicated the necessity of using tactual materials in geometry and science lessons and of supporting them with Braille alphabet and of a more organized classroom environment in comparison with other classes. And S65 emphasized the necessity of using concrete materials for geometry lesson. Finally, S69 mentioned about building a voice system for VIPs in classroom and using yellow strips which are used out of the buildings in classroom environment as well. In interviews S69 insisted that such a system will help VIPs listen to lesson easily with their hearing ability and they will move in classroom environment more freely.

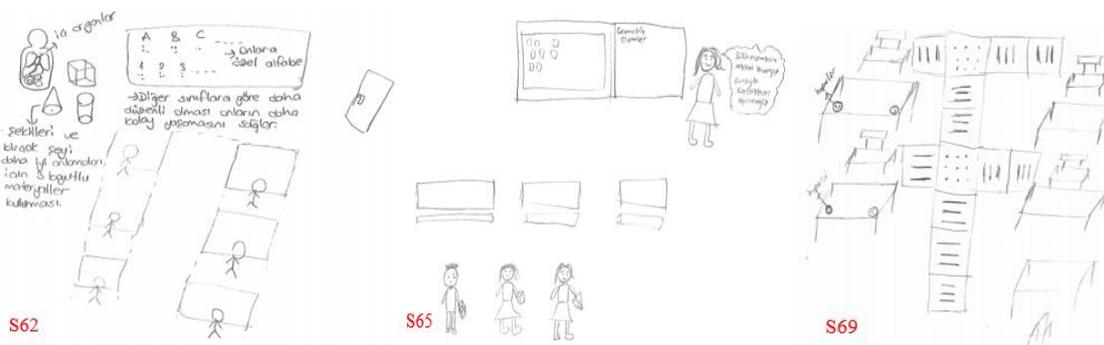


Figure 6. Some of the drawings based on educational environments

The last perceptions of PMTs about VIPs were the perceptions based on mental abilities. PMTs emphasized a rich fantasy world (11.4%), consistent estimation ability (2.9%) as positive points of view and their having poor fantasy (4.3%) world as negative points of view of VIPs (Figure 7). PMTs with positive perspective indicated that VIPs can visualize physical world if they are visually impaired from their birth and VIPs can visualize their memories if they are visually impaired later in life. PMTs also indicated that VIPs use their estimation ability when they meet unfamiliar objects and that they predict distances correctly. But PMTs with negative perspective indicated in their drawings that it is impossible to guess what VIPs think. However in interviews, they expressed that fantasy world of VIPs was not developed enough. For example, S43 drew a VIP approaching to her home as thinking 'I think there is little distance left to my home'. S58 drew concepts and objects occur in the mind of a total VIP and expressed they have a rich fantasy world. S33, on the other hand, considered a total VIP both from birth and later in life. According to this, S33 stated that she could not guess what a VIP from birth thinks and what was in her/his fantasy world was not clear (S33-1). Besides S33 also drew a total VIP later in life as s/he missed and visualized her/his old days in her/his mind (S33-2).



Figure 7. Some of the drawings based on mental abilities

Discussion

It is important to determine the perceptions about VIPs of PMTs who may teach mathematics to VIPs in future. Because, the perceptions of mathematics teachers may play a facilitating or an inhibiting role in translating curriculum guidelines into the complex and daily reality of classroom teaching (Haynes, 1996). That is, perceptions affect teaching approaches of teachers and how they handle the subjects (Hofer & Pintrich, 1997). Thus, the current study tried to reveal the perceptions of PMTs about VIPs and their environments without any direction and limitation. In this respect, the first perception was the environment where VIPs were handled. A large majority of the PMTs drew VIPs in open environments out of buildings. These were environments where VIPs walk near a road or on pavements, walk on embossed yellow strips, cross a street at traffic lights, dream/think, walk in the middle of a road, and sit in a park. It can be suggested here that PMTs think VIPs as having the independent mobility. Very few of PMTs handled VIPs in a closed environment such as in classroom and room or on stairs. But as future teachers PMTs were expected to picture classroom environment more. The third environment where PMTs drew VIPs was the abstract environment where there was no outdoor or indoor environment and full of images which were impossible to see on the world. Only a small part of the PMTs indicated that VIPs lived in a dark environment. However, this darkness represents a place where the VIPs do not see any objects and do not have even a sense of light. This result shows that the images of PMTs about VIPs are mostly the total VIPs. Finally, another environment depicted by PMTs was the environment where VIPs got help. According to this, VIPs should be helped in two ways; the first is always, and the second is in traffic when they cross a street.

The second perceptions which were determined from the drawings of PMTs were about the VIPs. These perceptions were affected from six different resources physical, emotional, sensual, environmental, educational and mental respectively. PMTs who were affected by physical resources described VIPs mostly as moving freely with the help of white cane, without any help or with both white cane and a guide dog. Actually independent mobility is to move to target securely, effectively and freely (Hill & Ponder, 1976). Here ability of independent mobility occurred mostly as white cane abilities. However, only two of the PMTs made picture to show that VIPs cannot move freely all their lives. On the other hand, 64 PMTs out of 70 made emphasis on gender by drawing females with long hair and males with short hair. Almost three fourth of PMTs emphasized here male gender and one fourth emphasized female gender for VIPs. This situation actually reflects the problem of gender discrimination in the society. According to the investigation of Arslan and his colleagues (2014), while visually impaired male persons can go out, visually impaired female persons are not allowed to go out in Turkey because of physical and sexual violence. Besides, almost half of the PMTs mentioned about glasses used by VIPs. Accordingly, 23 of PMTs mentioned the usage of black glasses and seven of them mentioned the usage of not black glasses. This finding supports the perception of total VIPs which was also a result of this study. This finding may be related to the usage of black glasses for VIPs in media and in society. But the perception that 'they cannot do anything' may deceive other people about what VIPs they can do (Bülbül, 2016).

The perceptions of PMTs about emotional world of VIPs were generally positive. According to this, they mentioned that VIPs are generally happy or neutral despite their disabilities or they may be anxious about their environment while they are moving. What was particularly noteworthy here was that PMTs drew VIPs with smiling faces. However, some social abilities which are natural for people with sight can be difficult for VIPs. Smiling is one of them, because smiling does not happen by itself like social reaction of people with sight (Vaughn et al., 2003).

It is also determined that PMTs also had perceptions that indicate which senses VIPs use. According to this, PMTs focused on senses of touching/feeling, hearing, smelling and tasting which are out of seeing sense for VIPs. This situation can be related to the information “the more senses are involved in learning process, the more and better one can learn” which can be explained by Edgar Dale's Cone of Experience. According to this, %85 of the information one individual gets from outer world is through seeing and this means that it is %85 less information for VIPs. This perception of PMTs overlaps with the expression of Özyürek (1995) “a VIP uses her/his other senses to achieve information”. As Buhagiar and Tanti (2011) indicated that in order for total VIPs to have a good conceptualization about the world around them, they have no other way to use their senses except their visual sense, that's to say, seeing sense. Because the information obtained through senses form the concepts about humans and objects (Fazzi & Klein, 2002).

Environmental perceptions of PMTs about VIPs were both positive and negative. PMTs with positive point of view drew pictures where life becomes easy after some environmental arrangements and the society accepts the VIPs. PMTs with negative point of view drew pictures where VIPs are excluded by the society and they have difficulties as a result of people's insensitivity and they are open to dangers. Accordingly, VIPs cannot define a burnt smell and a crash voice with just looking at their origins and so they cannot find suitable action (Gürsel, 2013:225). Therefore, they cannot react fast and properly. This finding is in accordance with the findings of other studies which indicate that VIPs who do not have opportunity to be equal in social relations and who cannot satisfy their needs enough are detached from social life, cannot find time for social relations and cannot feel themselves as a part of the society and become lonely (Çarkçı, 2011:47; İkizoğlu, 2005).

One of the most important results of the current study was the perceptions of PMTs based on education towards VIPs. In drawing where these perceptions emerged, PMTs portrayed the need for designing accessible educational environments, their designs for the VIPs, and even sample teaching environments for teaching mathematics. Accordingly, PMTs emphasized the usage of lesson materials with Braille alphabet and the necessity of making various arrangements in classrooms. This result was emphasized by very few PMTs, and this can be interpreted that PMTs do not have enough awareness about educational environments of VIPs or that PMTs do not have sufficient knowledge about these educational environments. When the insufficient academic studies on mathematics education for VIPs is taken into account, it can be understood that the perceptions of PMTs based on education are not at desired levels. One of the student characteristics which can affect the success of mathematics education is mental abilities. Perceptions of PMTs based on these abilities were shaped by positive and negative points of view. According to this, PMTs with positive perspective indicated that VIPs can visualize physical world if they are visually impaired from their birth and VIPs can visualize their memories if they are visually impaired later in life. PMTs also indicated that they use they estimation ability when they meet unfamiliar objects and that they predict distances correctly. But PMTs with negative perspective indicated that fantasy world of total VIPs does not develop enough. This situation overlaps with Kızır's [33] idea that VIPs may fail in abilities requiring especially abstract thinking as conceptual development and cognitive abilities of may be slow. However, contrary to what is believed, many psychological studies showed that total VIPs have amazing capacity of visual image and memory (Haber et al., 1993; Kennedy, 1993; Landau et al., 1984; Millar 1985).

As a result, PMTs drew more than one perception in their pictures from both same and different resources. This means that they have significant ideas about VIPs. There are also opposite perceptions as positive and negative among these. Among PMTs' positive ideas there are three different prominent perceptions. The first one is that VIPs can move freely in open air with the help of

their white cane and so, they can be happy. The second one is that VIPs do not see anything and like their lives through their senses of hearing and feeling. The third one is that VIPs are accepted by the society and so, they are happy. Two different perceptions are prominent among negative ideas of PMTs. The first one is VIPs are anxious because they are left alone and excluded by the society. As Gürsel (2013:226) indicates, it is normal that VIPs spend less time than their peers with sight. It is possible to note here that PMTs assume VIPs cannot see social messages of others and cannot react accordingly. The second one is VIPs are in danger in outdoor environment and because of this they are anxious. It is possible to note here that PMTs think so because VIPs cannot have information about the environment and cannot control (Gürsel, 2013:225). Although these positive and negative perceptions are expected to emerge, there is one unexpected perception as well. Some people in the society are insensitive but VIPs are happy with environmental arrangements and with them it is possible for VIPs to move freely. It is understood here that PMTs think VIPs have positive ideas about the life and difficulties do not scare them.

These results of the current study can be used as encouragement by PMTs for the education of VIPs. These PMTs can teach VIPs in inclusive classes or in schools for VIPs, and therefore determining their perceptions about VIPs can give clues about the content of the education to be given (Johnson, 2001). For that reason, necessary arrangements should be made to give proper and effective education and increase their proficiencies at undergraduate level for the mathematics teachers who will teach in inclusive classes and teach mathematics to VIPs. "Special Education" course in mathematics teaching program in education faculties can be used for this purpose. Opportunities to reinforce their knowledge about VIPs, to complete the insufficiencies and to correct the mistakes for PMTs can be provided in this course. The result of the current study showed that there is not much information about VIPs in closed environments such as classroom and house, and so, it can be possible to overcome this difficulty with the design of special education course both theoretically and practically. And thus, PMTs can have the ability to design flexible education environments regarding individual differences of their students, their needs and their sociocultural characteristics in accordance with Teaching Profession General Proficiencies (MEB, 2017). Beside of these, PMTs can be encouraged to participate to activities such as conferences, seminars related to special education during their undergraduate studies.

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