Levels of Students with Intellectual Disability in Associating Natural and Artificial Sounds to their Sources

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Abstract. The aim of this study is to determine levels of students with intellectual disability in associating natural and artificial sounds to their sources. In this study, case study method was used. The study sample consisted of a total of 15 students with intellectual disability selected from two secondary schools, one preschool and one special education school. In the study, a total of 17 pictorial cards illustrating 6 animals, 6 musical instruments and 5 environmental events, and the sounds related to the images on each card were used to collect data. In the process of implementation, each student was first given the pictorial cards and a sound belonging to one of the images on the cards was played. The student was asked to show the image to which the sound belonged and then to say the name of the image. This procedure was performed similarly for all the cards. The study results showed that students with intellectual disability better perceive and discriminate the sounds they encounter in daily life, but they have difficulty in identifying the sounds not encountered in daily life. Besides, it was determined that some students have difficulty in pronouncing the sounds.

Keywords: Science Education, Special Education, Student with Intellectual Disability, Natural Sound, Artificial Sound.

1. INTRODUCTION

Individual with intellectual disability is defined as an individual with below the normal intellectual functioning who presents deficiency in two or more skills belonging to the areas of skill that require adaptation in connection with the intellectual functions (self-expression, personal care, socialization, independent living, literacy and mathematics), said disability originating before the age of eighteen (AAIDD, 2010). As can be understood

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from this definition, it is quite difficult for the individuals with intellectual disability to perceive the concepts as they have conceptual deficits and limitations. It is necessary for the individuals with intellectual disability to gain knowledge and skills required to enable them to better understand the environment in which they exist, act according to the environmental circumstances and live in harmony and integrity with their surroundings. Understanding the concepts correctly is very important in gaining such knowledge and skills. The students with intellectual disability face greater difficulty in perceiving the concepts than the normal individuals. Therefore, the teachers should generate learning environments for the process of concept teaching taking the individual differences into consideration. The student with intellectual disability is an individual who displays for various reasons significant differences according to a certain standard from the peers in terms of personal characteristics and educational requirements. In other words, such students necessitate the implementation of individualized education programs that differ from the general rules of education, considering their physical properties or learning abilities (Ataman, 2005; Turnbull, Turnbull & Wehmeyer, 2007). Thus, Individualized Education Programs (IEP) developed on the student basis allow the identification of the needs of a student resulting from a disability, organization of the in- and out-of-class activities taking the needs of the student into consideration, monitoring of the progress of the student and enabling of the student to become independent and productive. Besides, having knowledge about the needs, competences and requirements of the students and being able to plan the teaching process in line with the student needs enable the teachers to be more efficient in terms of teaching and evaluation (Yıkmış, 2013).

Science is a discipline, which attempts to discover how the phenomena and events occur in nature by using the scientific research methods (such as experiments, observations, inquiries, etc.) and systematically produces the scientific information in this process. The science education may be briefly defined as the introduction to the individuals of the ways to analyze the phenomena and events in the environment within the framework of cause and effect relationship and the ways to mentally enhance via various thinking methods the new concepts acquired as a result of experience (Çepni, Küçük & Ayvacı, 2003; Tobin, 1986). As can be understood from this definition, the importance of science and science education is undeniable for the process through which the individual improves himself/herself on multidimensional terms and understands and adapts to the environment, world and universe where he/she lives. The aim of the science education is to introduce the science-related information of daily life to the individuals and contribute to the individual and social progress through the generation of a society aware of the scientific developments (Ministry of National Education [MEB], 2004). In other words, the aim of the science education is to raise all the students as scientifically literate individuals irrespective of the personal differences. A person who is scientifically literate has the basic knowledge about the sciences and has the scientific process skills for discovering the natural environment. Taking into account all these properties of science, it is extremely important to educate all the students, including the students with special needs, as scientifically literate persons. Çapraz (2016) and Mete (2016) stated in their studies that

the science education is important for developing and ensuring the permanence of science-oriented knowledge in the students with intellectual disability, developing their positive attitude towards the science education, increasing their science literacy rate and enabling their more active participation in daily life. As can be understood, the science education is important for the students with intellectual disability also. In special education, the Curriculum of Science Courses applied in the normal schools is used when determining the science outcomes for the individuals. An examination of the learning outcomes for the Primary and Secondary School Science Courses reveals that the 3rd grade in primary schools deals with the subjects of natural light sources and artificial light sources (MEB, 2018), the 5th and 6th grades in secondary schools cover the subjects of light and sound, the 7th grade teaches the light and the 8th grade teaches the sound (MEB, 2015). The learning outcomes for these subjects are specified in the curricula as follows: -Students are able to classify the surrounding sound sources as natural and artificial sound source (3rd Grade), -students know the sound-related topics of vibration, sound wave, natural and artificial sound sources, sound propagation and sound velocity. The 6th grade students gain knowledge about the sound-related subjects of vibration, sound wave, sound sources, sound propagation, sound intensity, sound reflection, sound reverberation, sound absorption and sound insulation (5th Grade). -Students are able to associate the sounds generated by the surrounding sound sources to the sound levels (8th grade). As can be seen, the concept of sound is included in the curricula of the science courses on all the levels from the 3rd grade in primary school through the 8th grade in secondary school. It is also very important for the individuals to perceive, recognize and discriminate the sounds they hear so that they can be aware of what is going on around them. As is known, the planning for the contents of the science courses in special education is made in a manner specific to the person by taking the Curriculum of Science Courses as the basis. The learning outcomes in this curriculum are not used exactly in the same way, but are customized according to the level of the student (easy level, medium level and hard level). The revised science outcomes appropriate for the students are specified in Individualized Education Programs (IEP) and Individualized Teaching Programs (ITP). On the other hand, it is alleged in the international body of literature that most of the students with intellectual disability receive no or very little education about the science (Courtade, Spooner and Browder, 2007; Therrien, Taylor, Hosp, Kaldenberg and Gorsh, 2011).

In Turkey, 29 doctoral thesis studies, 149 postgraduate thesis studies and 8 paper studies were conducted about the students with intellectual disability in the period of 2000-2018. Of these, only five are directly related to the science education (Çapraz, 2016; Çevik & Çevik, 2016; Demir, 2008; İlik, 2009; Mete, 2016). İlik (2009) investigated the effect of the direct teaching method on the perception of 3 students with mild learning disability of the concepts related to the solar system. As a result of the study, İlik (2009) concluded that the direct teaching method is effective on the comprehension levels of the students. In a similar study, Mete (2016) investigated the effect of the direct teaching method on the perception of the students with intellectual disability, studying at the secondary school

special sub-class, of the "hard-soft" properties of the materials. As a result of the study, Mete (2016) determined that of the students in the sample, two learned the concepts of "Hard-Soft", whereas the student with Down Syndrome was unable to learn. Moreover, only one of the students could recognize the hard objects upon seeing them on the pictorial card and was unable to recognize the soft objects. Çapraz (2016) attempted to teach the students with intellectual disability the substances in solid, liquid and gaseous states via direct teaching method. At the end of the study, Çapraz (2016) determined that three students learned the substances in solid, liquid and gaseous states, while one student had difficulty in learning and recalling the gaseous substances. Çevik and Çevik (2016) assessed the PUPA Project for the students with mild intellectual disability. Çevik and Çevik (2016) determined that the courses like science, mathematics, informatics and life sciences taught via Project Based Learning Approach (PBLA) significantly improved the academic achievement of the students and positively affected the students' attitude towards the courses. Demir (2008) studied the effectiveness of the staged teaching method in the perception of the students with intellectual disability of the subject of digestion. Demir (2008) determined that the method was effective in the perception of the students of the subject of digestion. As can be seen, there are a limited number of studies in our country on the teaching of the science concepts to the students with intellectual disability.

Considered in general, it can be seen that a limited number of science concepts, namely solids, liquids and gases (Çapraz, 2016), digestive system (Demir, 2008), hard-soft (Mete, 2016) and environmental pollution (Çevik & Çevik, 2016), were studied in relation to the individuals with intellectual disability. That the other science concepts (sound, light, heat, etc.) required by the individuals with intellectual disability to be able to maintain their daily lives independently of the other individuals have not been studied until the present is regarded as a deficiency. The individual's ability to correctly perceive the concept of sound and discriminate between the natural and artificial sounds is important for enabling the individual to discriminate and give correct reactions to the sounds heard in the surrounding environment in daily life. The close link between the science and daily life and the science-related nature of many events we encounter in daily life (thunder, lightning, rainfall, propagation of sound, etc.) entail the correct learning of the science concepts so that correct reactions may be given. The studies on the science concepts would contribute to the development of the mental world of the individuals with intellectual disability and to their establishment of new mental associations and constructs. As is known, every piece of new information enables the review of the mental constructs and the restructuring of the mind. In particular, the inaccurate mental construction of the basic concepts makes it more difficult for the individuals to learn the subsequent concepts and even causes them to construct the subsequent concepts inaccurately (Osborne & Wittrock, 1983). An incorrectly structured concept would probably cause the incorrect construction of a subsequently learned concept also. Studies on the basic concepts are needed in order to identify the fallacies developed by the individuals about the concepts and the problems encountered when learning the

concepts. Particularly, the studies about what science concept should be introduced on what level, the levels of students in comprehending the science concepts and the difficulties they encounter are primarily needed.

Purpose of the Study

The purpose of this study is to determine the levels of students with intellectual disability in associating natural and artificial sounds to their sources. Within the framework of this general aim, the answers were sought for the following sub goals:

1. Are the perception levels of the participating students for the natural and artificial sounds sufficient?

2. Are there differences between the performances of the students included in the study about the natural and artificial sounds?

3. Are there differences between the levels of students from various grades in perceiving the sounds and associating them to their sources?

2. METHOD

Study Model

The case study method, one of the qualitative research approaches, was employed in this study in order to determine the levels of students with intellectual disability in associating natural and artificial sounds to their sources. The case study method involves the in-depth picturization of the case under study in an unbiased manner by the researcher (Creswell, 2014). Yin (1984) describes the case study as a method employed for the instances where the researcher has very little or no control over the event being studied, the event or phenomenon is being studied within its natural environment and the focus is predominantly on the questions "how" and "why". In this study, it was attempted to identify the perceptions of the students of the natural and artificial sounds without intervening with them (without disrupting the natural environment), in a manner compatible with the definition by Yin (1984).

Participants

The sample of this study consists of 15 students with mild intellectual disability, 4 female and 11 male, picked from Yaylacık Secondary School, Ömer Burak Terzi Preschool, Cumhuriyet Secondary School and Çamlık Special Education Practice School in the 2017-2018 school year. The detailed information about the sample and the generated codes are presented in Table 1.

Table 1.

Distribution of the Variables in the Sample and the Codes

Schools	Location	Grade	Gender	N	Codes*
Preschool	City Center	Preschool	Male	3	AE1, AE2, AE3
Special Education Practice School	City Center	2	Female	3	IK1, IK2, IK3
			Male	3	IE1, IE2, IE3
Secondary School A	County Town	8	Female	1	OK1
			Male	2	OE4, OE5
Secondary School B	City Center	8	Male	3	OE1, OE2, OE3

 * In each code, the first symbol indicates the school, the second symbol indicates the gender and the third symbol indicates the serial number.

As can be seen in Table 1, the variables school, grade and gender were taken into consideration in the study. Further, the location of each school was indicated as the city center and the county town. However, the location was not considered as a variable for the study. In the last column of the table, each student was assigned a code based on the mentioned variables. For example, in the code AE1; the first symbol (A) indicates the school type, the second symbol (E) indicates the gender and the third symbol (1) indicates the serial number of the student.

The subject of natural and artificial sound sources addressed in this study is included in the scope of the behavior "classifies the surrounding sound sources as natural and artificial sound source" stated under the objective "Knows the Lights and Sounds around Us" in the curriculum of the Science Courses. The stated behavior is used in the scope of the science courses as a common goal for preschool through secondary school. In other words, the learning outcome being studied may be said to be common to all the students. Moreover, it was determined from the respective IEPs that the preliminary skill level of each participant in terms of learning outcome fell under the category "partially capable".

Data Collection Method

The data in this study were collected by the use of 17 pictorial cards illustrating 6 animals, 6 musical instruments and 5 environmental events, and the sounds corresponding to the images on these cards, as determined by the researchers for identifying the levels of students with intellectual disability in associating natural and artificial sounds to their sources. The sounds of animals and environmental events were used as natural sounds, while the sounds of musical instruments were used as artificial sounds. A representative exemplary image of each group is given in Figure 1.
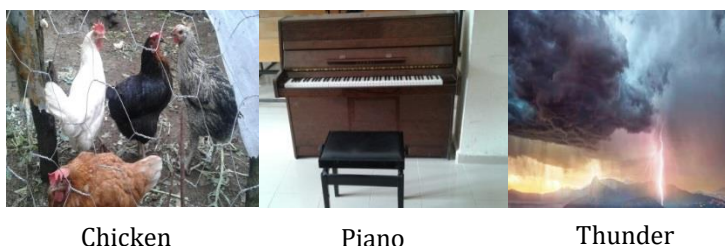
Chicken   Piano   Thunder

Figure 1. *Examples of the Images Used in the Study*

These groups are the animal sounds, musical instrument sounds and environmental sounds. Each group includes six sounds. The grouped sounds are in turn paired as follows: Cow sound-cat sound, kemancha sound-maraca sound, rain sound-wave sound. The researchers conducted one-to-one study with the students in order to determine their levels in perceiving the concept of sound. The researchers first put the card with 6 animal photos in front of the student. Then, they played to the student the sound of one of the animals shown on the card. Then, the student was asked to show on the card the animal to which the listened sound belonged and to say the name of the animal. The reactions given by the students in the meantime were recorded. This procedure was repeated once for each of the animal sounds. The answers of the students were recorded. The same procedure was carried out individually with each student for the musical instrument sounds and environmental sounds.

Data Analysis

For the analysis of data, the answers given by the students were classified under the categories "say" and "show". These categories were then presented in tabulated form. For the category "show", the symbol "C" was used for the correct answers and the symbol "IC" was used for the incorrect answers. For the category "say", the answers of the students were written exactly as they were given. The questions in the category "say" that were left unanswered were indicated by "Unresponsive".

3. RESULTS

In this section, the data obtained from the students participating in the study are presented within the framework of the problems studied.

Qualitative Data Obtained for the Natural and Artificial Sounds

Qualitative Data Obtained for the Natural Sounds

This section includes the results concerning the first sub problem of the study: "Are the perception levels of the participating students for the natural and artificial sounds sufficient?"

The first of the natural sounds is the animal sounds, and the qualitative data obtained from the listen-show-say exercise for the animal sounds are provided in Table 2.

Table 2.

Reactions of the Students to the Animal Sounds

Code	Animal sounds											
	İnek (Cow)		Kedi (Cat)		Yılan (Snake)		Horoz (Rooster)		Tavuk (Chicken)		Ayı (Bear)	
	Show	Say	Show	Say	Show	Say	Show	Say	Show	Say	Show	Say
AE1	C	İnek	C	Kedi	C	Sııss	IC	Unresponsive	C	Tavuk	C	Ayı
AE2	C	İnek	C	Kedi	IC	Unresponsive	C	Horoz	C	Tavuk	C	Ayı
AE3	C	İnek	C	Kedi	IC	Unresponsive	C	Horoz	C	Horoz	IC	Unresponsive
IE1	C	İnek	C	Kedi	IC	Unresponsive	C	Horoz	IC	Enek	IC	Unresponsive
IK1	C	Mee	IC	Ayy	IC	Unresponsive	C	Üüüü	IC	Cüccük	IC	Unresponsive
IK2	C	İnek	C	Kedi	IC	Unresponsive	C	Üüü	IC	Cıkcık	C	Uuu
IK3	C	Möö	IC	Miyav	IC	Unresponsive	C	Unresponsive	C	Gıdaak	C	Unresponsive
IE2	C	Möö	C	Kedi	C	Yılan	C	Üüüü	C	CikCik	IC	Unresponsive
IE3	C	İnek	C	Kedi	IC	Unresponsive	C	Horoz	C	Tavuk	IC	Unresponsive
OE1	C	İnek	C	Kedi	C	Yılan	C	Horoz	C	Tavuk	IC	Unresponsive
OE2	C	İnek	C	Kedi	IC	Unresponsive	C	Horoz	C	Tavuk	C	Unresponsive
OE3	C	İnek	C	Kedi	C	Unresponsive	C	Horoz	C	Tavuk	C	Unresponsive
OK1	C	İnek	C	Kedi	IC	Unresponsive	C	Horoz	C	Tavuk	IC	Unresponsive
OE4	C	İnek	C	Kedi	C	Yılan	C	Horoz	C	Tavuk	IC	Unresponsive
OE5	C	İnek	C	Kedi	C	Ssss	C	Horoz	C	Tavuk	C	Böö

* C: Correct; IC: Incorrect

When Table 2 is examined, it can be seen that, in the "show" exercise, all the students correctly associated the sound of "cow" to the picture of cow, 13 of the students (the students other than IK1 and IK3) correctly associated the sound of "cat" to the picture of cat, 6 of the students (the students other than AE2, AE3, IE1, IK1, IK2, IK3, IE3, OE2 and OK1) correctly associated the sound of "snake" to the picture of snake, all the students with the exception of AE1 correctly associated the sound of "rooster" to the picture of rooster, 12 of the students (the students other than IE1, IK1 and IK2) correctly associated the sound of "chicken" to the picture of chicken, and 7 of the students (the students other than AE3, IE1, IK1, IE2, IE3, OE1, OK1 and OE4) correctly associated the sound of "bear" to the picture of bear. In the "say" exercise; some of the students said the name of the animal, while some imitated the animal sound played (Table 2). As for the sound of cow,

12 of the students gave the correct answer, whereas 3 preferred to imitate the sound of cow. The student with the code IK1 gave the answer ''Mee'', while the students with codes IK3 and IE2 gave the answer ''Möö'. As for the sound of cat, 13 of the students gave the correct answer, whereas 2 (IK1 and IK3) used the expressions ''Ayy'' and ''Miyav'', respectively. As for the sound of snake, 3 of the students gave the correct answer. Of the remaining 12 students, OE5 and AE1 responded with the incorrect expressions of ''Ssss'' and ''Sısss'', respectively, and the remaining 10 students were unresponsive. As for the sound of rooster, 10 of the students gave exact correct answers. Of the remaining 5 students, AE1 and IK3 did not give any answer, while IK1, IK2 and IE2 used the incorrect expression of ''Üüüü''. As for the sound of chicken, 9 of the students gave the correct answer. Of the remaining 6 students, AE3, IE1, IK1, IK2, IK3 and IE2 used the incorrect expressions of ''Horoz'', ''Enek'', ''Cücücük'', ''Cıkcık'', ''Gıdak'' and ''Cikcik'', respectively. As for the sound of bear, 2 of the students gave the correct answer. Of the remaining 13 students, OE5 and IK2 used the incorrect expressions of 'böö' and 'uuu', respectively, and the other 11 students did not give any answer (Table 2).

The second of the natural sounds is the environmental sounds, and the qualitative data obtained from the listen-show-say exercise for the environmental sounds are provided in Table 3.

Table 3.

Reactions of the Students to the Environmental Sounds

	Environmental Sounds									
	Gök Gürültüsü (Thunder)		Dalga (Wave)		Rüzgar (Wind)		Yağmur (Rain)		Su (Water)	
	Show	Say	Show	Say	Show	Say	Show	Say	Show	Say
AE1	IC	Unresponsive	IC	Unresponsive	C	Unresponsive	C	Unresponsive	IC	Unresponsive
AE2	C	Bulut	IC	Üüüüü	C	Buluu	C	Unresponsive	C	Su
AE3	C	Unresponsive	IC	Su	IC	Unresponsive	C	Unresponsive	C	Su
IE1	IC	Unresponsive	C	Unresponsive	C	Unresponsive	C	Yağmur	IC	Enek
IK1	IC	Unresponsive	C	Ve	C	Tüta	C	Rrrr	C	Cu
IK2	C	Yağmur	C	Su	C	Unresponsive	C	Su	C	Su
IK3	C	Su	C	Su	IC	Vuu	C	Su	C	Su
IE2	IC	Unresponsive	IC	Unresponsive	C	Araba	IC	Unresponsive	C	Su
IE3	IC	Unresponsive	C	UpUp	C	Iğğğğ	C	BıtBıt	C	Su

OE1	C	Şimşek	C	Rüzgar	C	Rüzgar	C	Kulaklık	C	Yağmur
OE2	C	Şimşek	C	Dalga	C	Fırtına	C	Yağmur	C	Musluk
OE3	C	Yıldırım	C	Rüzgar	C	Fırtına	C	Dalga	C	Su
OK1	C	Gök gürültüsü	C	Dere	C	Rüzgar	C	Martı	C	Su
OE4	C	Şimşek	C	Dere	C	Rüzgar	C	Ateş	C	Su
OE5	C	Şimşek	C	Dere	C	Rüzgar	C	Rüzgar	C	Su

*C: Correct; IC: Incorrect

When Table 3 is examined, it can be seen that 10 of the students (the students other than AE1, IE1, IK1, IE2 and IE3) correctly associated the sound of "thunder" to the picture of thunder, 11 of the students (the students other than AE1, AE2, AE3 and IE2) correctly associated the sound of "wave" to the picture of wave, 13 of the students (the students other than AE3 and IK3) correctly associated the sound of "wind" to the picture of wind, all the students with the exception of IE2 correctly associated the sound of "rain" to the picture of rain, and 13 of the students (the students other than AE1 and IE1) correctly associated the sound of "water" to the picture of water. In the "say" exercise; some of the students said the name of the environmental event, while some preferred to imitate the environmental sound played. As for the image of thunder, OK1 gave the correct answer and 4 students gave incorrect answers (AE2 "bulut (cloud)", IK2 "yağmur (rain)", IK3 "su (water)", OE3 "yıldırım (thunderbolt)"). For this image, the students responding with the answers "şimşek (lightning)" (OE1, OE2, OE4 and OE5) and "yıldırım (thunderbolt)" (OE3) were also deemed to answer correctly. The remaining 6 students (AE1, AE3, IE1, IK1, IE2, IE3) did not give any response. As for the sound of wave, OE2 gave the correct answer and 11 students gave incorrect answers (OE1 and OE3 "rüzgar (wind)", OK1, OE4 and OE5 "dere (stream)", AE2 "üüü", AE3 "su (water)", IK1, IK2 and IK3 "su (water)", IE3 "upup"). The remaining 3 students (AE1, IE1, IE2) remained unresponsive. As for the sound of wind, 4 of the students gave the correct answer and 7 gave incorrect answers (AE2 'buluu', IK1 'tuta', IK3 'vuu', IE2 'araba (car)', IE3 'ığğğ', OE2 and OE3 "fırtına (storm)"). The remaining 4 students (AE1, AE3, IE1, IK2) did not give any response. As for the sound of rain, 2 of the students gave the correct answer and 9 used incorrect phrases (OE1 "kulaklık (earpiece)", OE3 "dalga (wave)", OK1 "martı (seagull)", OE4 "ateş (fire)", OE5 "rüzgâr (wind)", IK1 "rrrr", IK2 and IK3 "su (water)", IE3 "bıtbıt"). The remaining 4 students (AE1, AE2, AE3, IE2) remained unresponsive. As for the sound of water, 10 of the students gave the correct answer and 4 gave incorrect answers (OE1 "yağmur (rain)", OE2 "musluk (tap)", IE1 "enek" and IK1 "cuu"). The remaining student (AE1) did not give any response.

Qualitative Data Obtained for the Artificial Sounds

The qualitative data obtained from the listen-show-say exercise for the musical instrument sounds used as the artificial sound in the study are presented in Table 4.

Table 4.

Reactions of the Students to the Musical Instrument Sounds

	Musical Instrument Sounds											
	Kemençe (Kemancha)		Gitar (Guitar)		Bağlama (Baglama)		Marakas (Maraca)		Piyano (Piano)		Davul (Drum)	
	Show	Say	Show	Say	Show	Say	Show	Say	Show	Say	Show	Say
AE1	C	Unresponsive	IC	Unresponsive	C	Unresponsive	C	Unresponsive	IC	Unresponsive	IC	Bumbum
AE2	C	Unresponsive	IC	Unresponsive	IC	Unresponsive	C	Markas	IC	Unresponsive	IC	Bambam
AE3	C	Unresponsive	IC	Unresponsive	IC	Unresponsive	C	Unresponsive	IC	Unresponsive	IC	Unresponsive
IE1	C	Bu ses	IC	Bu ses	IC	Bu ses	C	Ses	IC	Ses	C	Davul
IK1	C	Unresponsive	IC	Unresponsive	C	Unresponsive	C	Unresponsive	IC	Nü	C	Unresponsive
IK2	C	Mekençe	IC	Unresponsive	IC	Unresponsive	IC	Unresponsive	C	Unresponsive	C	Ses
IK3	IC	DıtDıt	IC	Unresponsive	C	Sıız	C	Unresponsive	IC	Unresponsive	C	Davul
IE2	C	Unresponsive	C	Gitar	C	Unresponsive	C	Marakas	IC	Unresponsive	IC	Unresponsive
IE3	C	Kemençe	C	Gitar	C	Unresponsive	C	Unresponsive	C	Unresponsive	C	Davul
OE1	C	Kemençe	IC	Saz	C	Gitar	C	Darbuka	C	Piyano	C	Davul
OE2	C	Kemençe	IC	Unresponsive	C	Unresponsive	C	Unresponsive	C	Saz	C	Davul
OE3	C	Kemençe	C	Gitar	C	Gitar	C	Çıngırak	IC	Akorto	C	Davul
OK1	C	Kemençe	C	Gitar	C	Bağlama	C	Fotoğraf makinesi	C	Piyano	C	Müzik
OE4	C	Horon	C	Gitar	C	Şarkı	C	Şarkı	C	Şarkı	C	Davul
OE5	C	Kemençe	C	Çalgı	C	Saz	C	Taş	IC	Flüt	C	Davul

When Table 4 is examined, it can be seen that, in the "show" exercise, all the students with the exception of IK3 correctly associated the sound of "kemancha" to the picture of kemancha, 6 of the students (the students other than AE1, AE2, AE3, IE1, IK1, IK2, IK3,

OE1 and OE2) correctly associated the sound of "guitar" to the picture of guitar, 11 of the students (the students other than AE2, AE3, IE1 and IK2) correctly associated the sound of "baglama" to the picture of baglama, all the students with the exception of IK2 correctly associated the sound of "maraca" to the picture of maraca, 6 of the students (the students other than AE1, AE2, AE3, IE1, IK1, IK3, IE2, OE3 and OE5) correctly associated the sound of "piano" to the picture of piano, and 11 of the students (the students other than AE1, AE2, AE3 and IE2) correctly associated the sound of "drum" to the picture of drum. In the "say" exercise, some of the students said the name of the musical instrument, while some imitated the sound played, as was the case with the animal sounds. As for the sound of kemancha, 6 of the students gave the correct answer and 4 gave incorrect answers (OE4 "Horon (a kind of folk dance)", IE1 "Bu ses (this sound)", IK2 "mekençe", IK3 "Dıtdıt"). The remaining 5 students (AE1, AE2, AE3, IK1, IE2) remained unresponsive. As for the sound of guitar, 5 of the students gave the correct answer and 3 gave incorrect answers (IE1 "Bu ses (this sound)", OE1 "Saz (a stringed folk instrument)" and OE5 "Çalgı (instrument)"). The remaining 7 students remained unresponsive. As for the sound of baglama, the student OK1 gave the correct answer and 6 students gave incorrect answers (OE1 "gitar (guitar)", OE3 "gitar (guitar)", OE4 "şarkı (song)", IE1 "bu ses (this sound)", OE5 "saz (a stringed folk instrument)" and IK3 "sıız"). The remaining 8 students (AE1, AE2, AE3, IK1, IK2, IE2, IE3, OE2) remained unresponsive. As for the sound of maraca, 2 of the students gave the correct answer and 6 gave incorrect answers (OE1 "darbuka (a kind of drum)", OE3 "çıngırak (bell)", OK1 "fotoğraf makinesi (camera)", OE4 "şarkı (song)", OE5 "taş (stone)" and IE1 "ses (sound)". The remaining 7 students (AE1, AE3, IK1, IK2, IK3, IE3, OE2) remained unresponsive. As for the sound of piano, 2 of the students gave the correct answer and 6 gave incorrect answers (OE2 "saz (a stringed folk instrument)", OE3 "akorto", OE4 "şarkı (song)", OE5 "flüt (flute)", IE1 "ses (sound)", IK1 "nü"). The remaining 7 students (AE1, AE2, AE3, IK2, IK3, IE2, IE3) remained unresponsive. As for the sound of drum, 8 of the students gave the correct answer and 4 gave incorrect answers (OK1 "müzik (music)", AE1 "bum bum", AE2 "bam bam" and IK2 "ses (sound)"). The remaining 3 students (AE3, IK1, IE2) remained unresponsive.

Quantitative Data Obtained for the Natural and Artificial Sounds

Quantitative Data for the Natural and Artificial Sounds

This section provides the results concerning the second question of the study: "Are there differences between the performances of the students included in the study about the natural and artificial sounds?" The quantitative data obtained for this question of the study from the natural sounds (Animals and Environmental Events) are provided in Table 5 and the quantitative data obtained from the artificial sounds (Musical Instruments) are provided in Table 6.

Table 5.

Average Values Obtained for Natural Sounds

	Animal Sound				Environmental Sound			
	Show		Say		Show		Say	
	$\overline{X}$ (%)		$\overline{X}$	(%)	$\overline{X}$	(%)	$\overline{X}$	(%)
Preschool	4,3	(71,7)	2,3	(38,3)	3	(60)	0,6	(12)
Primary School	3,5	(58,3)	1,5	(25)	3,6	(72)	0,8	(16)
Secondary School	5,2	(86,7)	3,6	(60)	5	(100)	2,1	(42)
General Average	4,3	(71,7)	2,46	(41)	4,6	(92)	1,39	(27,8)

When Table 5 is examined, it can be seen that, in the "show" exercise, the students got a general average of 4,6 (92%) for the environmental sounds and a general average of 4,3 (71,7%) for the animal sounds. In the "say" exercise, the students got a general average of 2,46 (41%) for the animal sounds and a general average of 1,39 (27,8%) for the environmental sounds. When the average numbers of correct answers given by the students for the animal sounds under the natural sounds are examined, it can be seen from Table 5 that, in the "show" exercise, the preschool students, the primary school students and the secondary school students had the values of 4,3 (71,7%), 3,5 (58,3%) and 5,2 (86,7%), respectively. In the "say" exercise, the preschool students, the primary school students and the secondary school students were observed to have the values of 2,3 (38,3%), 1,5 (25%) and 3,6 (60%), respectively (Table 5). As for the environmental sounds, the average numbers of correct answers given in the "show" exercise were found as 3 (60%), 3,6 (72%) and 5 (100%) for the preschool students, the primary school students and the secondary school students, respectively, and the averages for the "say" exercise were found as 0,6 (12%), 0,8 (16%) and 2,1 (42%) for the preschool students, the primary school students and the secondary school students, respectively (Table 5). Based on the data in Table 5, the general average of the students for the natural sounds was calculated as (4,3 + 4,6)/2= 4,45 (81,8%) for the "show" exercise and (2,46 + 1,39)/2= 1,97 (34,4%) for the "say" exercise.

The average and percentage values obtained for the artificial sounds are given in Table 6 on the grade basis and as sums.

Table 6.

Average Values Obtained for Artificial Sounds

| | Musical Instrument Sound | | | |
| | Show | | Say | |
	$\overline{X}$	(%)	$\overline{X}$	(%)
Preschool	2,3	(38,3)	0,6	(12)
Primary School	1,5	(25)	1,1	(18,3)
Secondary School	3,6	(60)	2,6	(43,3)
General Average	2,46	(41)	1,43	(24,5)

According to Table 6, all the students got an average of 2,46 (41%) in the "show" exercise and an average of 1,43 (24,5%) in the "say" exercise for the sounds of musical instruments. When the data are examined on the basis of the variable grade; the preschool, the primary school and the secondary school had an average of 2,3 (38,3%), 1,5 (25%) and 3,6 (60%), respectively, in the "show" exercise, and the preschool, the primary school and the secondary school had an average of 0,6 (12%), 1,1 (18,3%) and 2,6 (43,3%), respectively in the "say" exercise (Table 6).

Quantitative Data Obtained for Various Grades

This section provides the results concerning the third question of the study: "Are there differences between the levels of students from various grades in perceiving the sounds and associating them to their sources?" The variation in the performance of the students with increasing grade level is provided in Figure 2 for the categories "show" and "say".
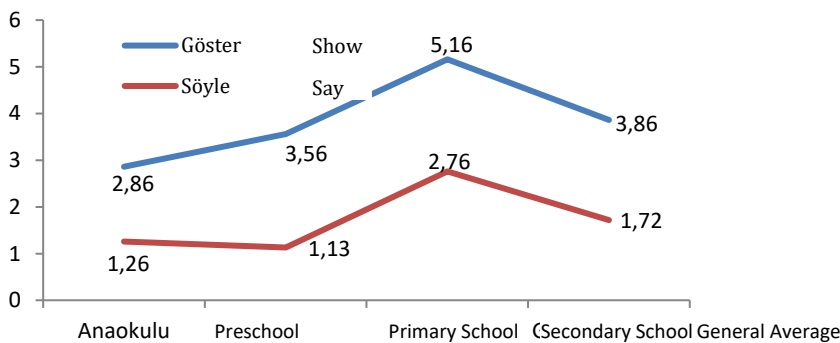

Figure 2. *Averages of the Student Groups for the Categories "Show" and "Say"*

As can be seen in Figure 2, the averages of the preschool students, the primary school students and the secondary school students for all the sounds are 2,86, 3,56 and 5,16,

respectively, in the "show" category. On the other hand, the averages of the preschool students, the primary school students and the secondary school students for all the sounds are 1,26, 1,13 and 2,76, respectively, in the "say" category. Based on this, the general average of all the students was calculated as 3,86 for the "show" category and 1,72 for the "say" category. Based on the data in Figure 2, the averages of two exercises were calculated as (5,16+2,76)/2= 3,96 (66%) for the secondary school, (3,56+1,13)/2= 2,35 (39%) for the primary school and (2,86+1,26)/2= 2,06 (34%) for the preschool.

4. CONCLUSION, DISCUSSIONS AND SUGGESTIONS

Discussion

In this study, it was aimed to determine the levels of students with intellectual disability in associating natural and artificial sounds to their sources. For this purpose, 17 pictorial cards illustrating 6 animals, 6 musical instruments and 5 environmental events, and the sounds corresponding to the images on these cards were used. One of the main purposes of the education provided to the students with intellectual disability is to improve their skills of adapting to their environment and maintaining their lives independently of the others (Boyle and Scanlon, 2009). One of the significant indicators of such skills is the level of awareness of the individuals of the events occurring in their surroundings. This study was performed by the use of the concept of sound, which is something embedded in life and encountered by the individuals all the time in daily life (Demirci and Efe, 2007). When selecting the sound sources for the study, the sounds generated in the immediate surroundings of the individuals were given priority. The sounds of animals, musical instruments and environmental events, which are more likely to be experienced by the students in their surroundings, were preferred. Bishop (1999) and Fleming and Levie (1993) indicated that the materials intended for the students should be selected from the circumstances they encounter in daily life. Further, care was taken to ensure that the selected materials were appropriate for the level of the children of this age and with this condition. In fact, it can be understood from the answers given by the students that the materials employed are appropriate for their level.

Discussion on the Levels of Perception of the Natural and Artificial Sounds

In this section, the results concerning the first sub problem of the study are discussed: "Are the perception levels of the participating students for the natural and artificial sounds sufficient?"

As can be seen in Table 2, all the students correctly associated the sound of cow to the picture of cow. The ability of the preschool students to correctly perform this matching despite their lack of reading-writing skills is considered to be quite significant. As for the cat sound, all the students except for the students with codes IK1 and IK3 made the correct matching (Table 2). These results are expectable, since both animals are of the species once can encounter frequently in daily life. On the contrary, most of the students were unable to correctly match the sound of snake. While 7 students correctly associated the

sound of bear to the picture of bear, 8 students made this association incorrectly. It was observed that the students "OE5" and "IK2" gave the incorrect answers of "böö" and "uuu", because they did not know the name of the bear despite being familiar with the animal. Of the students participating in the study, only the preschool students with codes AE1 and AE2 both correctly associated the sound of bear to the picture of bear and correctly said the name for the animal. It is quite surprising that they made the correct matching unlike the other student groups with more advanced level of age and experience. The reason for these two preschool students being able to give the full correct answers to this question could be that they watch documentary films at home or they visit the zoo. The reason is that the bear is not a living being we could encounter in daily life. It is understood that the preschool students had better recognize the animals illustrated on the cards and better associate these animals to their sounds than the primary school students. This is a situation contrary to the expectations. One reason for this could be that the students encounter the mentioned animals on a greater number of occasions in the environment where they live. Another reason could be that some families keep an animal at home. The individuals with a pet in the house usually have greater conscience for the animals and environment. From this point of view, it can be said that the preschool students have greater interest and conscience for the animals. However, when evaluating this finding, it should be considered as a limitation that the number of sample is very small. On the other hand, the secondary school students displayed the highest overall performance for the animal sounds. This situation is expectable, as the knowledge and experience increase with advancing age. In a similar study in literature, it was determined that the students with mild intellectual disability of the age group of 8-15 studying at a special education center had difficulty in discriminating the sounds of "duck-chicken", "cat-lamb" and "bird-dog" in a show-say exercise (Sucuoğlu, 1979).

As can be seen in Table 3, 10 students correctly associated the sound of thunder, whereas 5 students showed the incorrect picture. When asked to say the name of the thing to which the played sound belongs, the students OK1, OE1, OE2, OE4 and OE5 gave the correct answer. Here, 4 students used the term "şimşek (lightning)" and 1 student used the term "yıldırım (thunderbolt)" instead of the term for thunder. These terms were also regarded to be correct as the image used (Figure 1) is appropriate for all three terms. Of the remaining students, 2 gave incorrect answers, while 6 remained unresponsive. The students from the group of secondary school were determined to better discriminate the played sound than the other student groups. The reason for the inability of the students to associate the thunder to the correct image could be that they could not match the thunder they hear in daily life with the source of this sound. Probably, the students are aware of and have experienced the thunder in daily life, but they could not give the correct answer as they do not know what causes it. It is stated in the literature that even the normal individuals have incorrect knowledge about the thunder and are unable to correctly explain the cause of this phenomenon (Aydın and Özkara, 2011). The reason is that it is necessary to evaluate the concepts of light, electric arc and sound together for this frequently experienced natural event. 11 students correctly associated the wave

sound. 4 students (AE1, AE2, AE3, IE2) showed the incorrect picture. Regarding the association of the wave sound to its picture, the student OE2 was observed to give the correct answer. 3 students (AE1, IE1, IE2) left the section "say" blank. 13 of the students correctly associated the wind and rain sounds. The remaining 2 students (AE3 and IK3) showed the incorrect picture. That the sounds of wind and rain were discriminated by nearly all the students from the three student groups is believed to result from their greater extent of experience with these two sounds. 13 of the students correctly associated the sound of water. As a result, it is observed that the secondary school students are more successful with the environmental sounds under the natural sounds. Increasing the sound awareness of the individuals with this condition, even having them try to discriminate between the sounds, is extremely important for the positive development of their perspective of science. Rendering the science courses more enjoyable for the students with intellectual disability could be possible if the students are able to attribute new meanings to the objects and circumstances in the environment where they are present (İlik, 2009; Kaplan, 1999).

As can be seen in Table 4, of the musical instrument sounds, all the students with the exception of the student with code IK3 correctly associated the sound of kemancha to the picture of kemancha. When asked to say the thing to which the played sound belonged, 6 students were found to give the correct answer. 4 students (OE1, IE1, IK2, IK3) were observed to give different answers. It was observed that 5 students (AE1, AE2, AE3, IK1, IE2) did not give any answer as they did not know the sound. Thus, it is also surprising that some of the primary school students were unable to match with the source the sound of kemancha, which they in fact frequently encounter in daily life. It was observed that 6 students (IE2, IE3, OE3, OK1, OE4, OE5) showed the correct picture for the guitar sound, while 9 students showed the incorrect picture. The students OE1 and IE1 were found to give the incorrect answers of "saz (a stringed folk instrument)" and "bu ses (this sound)" as they did not know that the played sound belongs to guitar. It is possible that these students have never seen a guitar before. 11 of the students, i.e. the students other than AE2, AE3, IE1 and IK2, correctly associated the sound of baglama to the picture of baglama. The secondary school students were more successful in matching the sound of baglama to its source. All the students except for IK2 correctly associated the sound of maraca to the picture of maraca. However, only the primary school student with code IE2 could correctly pronounce the word maraca. The reason for this could be that the term maraca is difficult to pronounce and that maraca is an instrument not much frequently encountered in daily life. In the secondary school group, only two students (OE3, OE5) failed to match the sound of piano with the correct image. In the primary school group, only two students (IE3, IK2) made the correct matching. In preschool, there was no student giving the correct answer. In the "say" exercise, only two students (OE1, OK1) were determined to correctly say the name of the piano. 11 students showed the correct picture for the drum sound. 4 students (AE1, AE2, AE3, IE2) showed incorrect pictures. The reason for the primary school and secondary school student groups being able to correctly discriminate the sound of drum could be that it is a musical instrument they

frequently encounter in their surroundings. Sucuoğlu (1979) conducted the show-say exercise also with the sounds of musical instruments like "drum-tambourine" and "drum-xylophone" in addition to the above-mentioned animal sounds. It was determined the students with intellectual disability selected taking various areas of development (physical, mental, etc.) into consideration have difficulty in discriminating different sounds.

Discussion on the Performances for the Natural and Artificial Sounds

In this section, the results concerning the second question of the study are discussed: "Are there differences between the performances of the students included in the study about the natural and artificial sounds?"

An examination of the results of the "show" exercise for the natural sounds in Table 5 reveals that the students got an average of 4,6 (92%) for the environmental sounds and an average of 4,3 (71,7%) for the animal sounds. To the contrary, the performances of the students for the musical sounds (musical instrument sounds) remained at the level of 2,46 (41%) in the "show" exercise. From this point of view, it could be said that the students are more successful with natural sounds. The primary reason for this is that the students encounter the natural sounds more frequently. In the "say" exercise, the students got the averages of 2,46 (41%) and 1,39 (27,8%), respectively, for the animal sounds and environmental sounds. The general average obtained in this category for the natural sounds is 1,97. For the artificial sounds, the average for the "say" category was found to be 1,43. In this category too, the performances for the natural sounds were determined to be higher. Moreover, it is understood that the performances of the students for the animal sounds under the natural sounds are higher than those for the other natural sounds and artificial sounds. Thus, it can be said that the animals have an important place in the life of the children. It is even thought that the animals contribute to the children's perception of the sounds and their development regarding the concept of sound. Association of the experiences gained in daily life to what is learned at school provides significant contributions in educating the scientifically literate individuals. Since the sound is a concept frequently encountered in daily life, it is necessary to employ this concept in developing the scientific literacy in the students. On the other hand, if a student is left alone with the daily life experiences, he/she would probably develop fallacies for the concepts experienced. The reason is that the daily experiences are the primary cause for the fallacies (Gürel, Güven and Gürdal, 2003). The experiences gained in daily life without the guidance of a teacher lead the children to the wrong destinations from the scientific perspective. It is argued that the skills of associating the concepts are not very good especially in the students of the younger ages (Sikder & Fleer, 2014). Learning the science concepts is different from the knowledge of daily life and necessitates the guidance of a teacher.

Discussion on the Performances of the Individuals from Various Grades for the Natural and Artificial Sounds

In this section, the results concerning the third question of the study are discussed: "Are there differences between the levels of students from various grades in perceiving the sounds and associating them to their sources?"

As can be seen in Figure 2, the students exhibited higher performance in the "show" exercise ($\bar{X}$=3,86). The most important reason for this is that even though the students are able to hear the sounds and see the things to which they belong in the natural environment without needing a teacher, they need a teacher in order to learn the names of the sound sources. The performances in the "show" exercise exhibited an increase from the preschool towards the secondary school. The performances in the "say" exercise were lower in all three groups than those in the "show" exercise. Based on this, it is understood that the skills of the students in associating the listened sounds to the respective sound sources are greater than their skills in saying the names of the sources to which the sounds belong. Contrary to the expectations, the preschool students were observed to exhibit a higher, even if slightly, performance than the primary school students in the "say" exercise (preschool 1,26; primary school 1,13) (Figure 2). On the other hand, it can be seen in Figure 2 that the secondary school students displayed higher performance for all the sounds as compared to the other student groups, both in "show" ($\bar{X}$=5,16) and "say" ($\bar{X}$=2,76) exercises. When the success of the students for the "show" and "say" exercises is examined, the secondary school students, primary school students and preschool students are observed to achieve the success rates of 66%, 39% and 34%, respectively. This situation is expectable, since the human brain and internal organs show growth in terms of structure and size with advancing age. The development in the brain brings with it an increasingly improving discernment in the individual (Doğan, 2007).

Looking at the answers of the students with intellectual disability to the animal sounds under the natural sounds, the preschool students ($\bar{X}$=4,3 and $\bar{X}$=2,3) are observed to be more successful than the primary school students ($\bar{X}$=3,5 and $\bar{X}$=1,5), in both the show and say categories (Table 5). When the average numbers of the correct answers of the students with intellectual disability to the environmental sounds are examined, it can be seen that the secondary school students ($\bar{X}$=5,0 and $\bar{X}$=2,1) associate the sounds more correctly as compared to the other student groups, in both the show and say categories (Table 5). The reason for the low average number of correct answers given by the preschool students to the environmental sounds ($\bar{X}$=3,0 and $\bar{X}$=0,6) could be that they have less interaction with the environment than the other groups.

When the average numbers of the correct answers of the students with intellectual disability to the musical instrument sounds in Table 6 are examined, it is observed the secondary school students ($\bar{X}$=5,3 and $\bar{X}$=2,6) more correctly associated the sounds to their sources and more correctly pronounced the names of the sound sources than the other student groups, in both the show and say categories (Table 6). The lower average number of correct answers given by the preschool students to the musical instrument

sounds ($\bar{X}$=1,3 and $\bar{X}$=0,6) could be caused by the fact that the skills of observation and listening of the preschoolers have not developed as they are yet illiterate. In a study by Birinci and Apaydın (2016), it was observed that the students gave natural and artificial examples of "sound sources", the subject of the sub problem. The students were observed to mention "living beings" as the examples of natural sound sources (25 (75.76%)) and "musical instruments" as the examples of artificial sound sources (12 (36,36%)). The Modeling Based Teaching Method was found to increase the knowledge level of the students. Additionally, although much variation was not observed in the knowledge about "sound sources", 9 students (69,7%) used a phrase meaning "every substance may be a sound source".

According to Table 5, the participants got the average of 4,6 (92%) for the environmental sounds and the average of 4,3 (71,7%) for the animal sounds in the "show" exercise. From this point of view, it can be said that the students are more familiar with the environmental sounds and animal sounds. Because these two sound types are also the natural sounds, it is understood that the students are more successful with the natural sounds. In the "say" exercise, the students got the average of 2,46 (41%) for the animal sounds and the average of 1,39 (27,8%) for the environmental sounds. Here too, the animal sounds ranked the first, while the average for the environmental sounds came out low. According to Table 6, the participants had the average of 1,43 (24,5%) in the "show" exercise and the average of 2,46 (41%) in the "say" exercise, for the musical instrument sounds. The students had difficulty in saying the names of the musical sound sources.

Conclusion

As a result of the study, it was determined that the students have higher performance for the natural sounds than for the artificial sounds. In furtherance of this result, it was concluded that the students are better in perceiving and discriminating the sounds they experience in daily life, but they have difficulty in perceiving and discriminating the sounds they never or less frequently experience in daily life. Another result obtained from the study is that the skills of the students in associating the natural and artificial sounds to their sources and pronouncing the names of the sources generally increase with advancing age. On the other hand, after the examination of the data in detail, it was concluded that the overall sound-related performances of the students from the preschool and primary school were much lower than that of the secondary school students. When "say" exercise and "show" exercise were compared, the students were determined to be more successful in the "show" exercise. Thus, it was concluded that majority of the students are able to associate the sound they hear to its source. Although the performance was low in all the groups in the "say" exercise, the performance of the primary school students was found to be lower than the other groups. It was concluded that the students participating in the study are generally unable to correctly pronounce the names of the sound sources.

The most remarkable result obtained from the study is that the preschool students ($\bar{X}$=4,3 and $\bar{X}$=2,3) were more successful than the primary school students ($\bar{X}$=3,5 and $\bar{X}$=1,5)

with the animal sounds. In fact, the only two students who correctly said the name of the bear were from the preschool students. Thus, it can be said that the preschool students have greater interest and conscience for the animals.

Recommendations

The studies for discriminating the natural and artificial sounds should be included in the education programs for all the preschoolers. The reason is that the observation skills of the children from the preschool age are more effective as they do not yet know how to read and write. Thus, the exercises of matching the sounds with their sources and the show-say exercises should be included when teaching the concepts of natural and artificial sound. The studies emphasize that the exercises with the concept of sound assist the child in listening to the surroundings more consciously and perceiving and discriminating the sounds listened. Furthermore, the special education teachers should take into consideration the possibilities of the students, schools and school environments regarding the science course and should plan the course bearing these features in mind.

The science course involves too many abstract and technical concepts. Thus, both the students with special needs and the normal students usually face difficulty in learning the conceptual knowledge and are unable to properly use the concepts they learn. To ensure the comprehensibility and permanence of these abstract concepts, the science course provided to the students with special needs should be supported with the audiovisual tools and materials.

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In the writing process of the study titled "Levels of Students with Intellectual Disability in Associating Natural and Artificial Sounds to their Sources", the rules of scientific, ethical and citation were followed; it was undertaken by the authors of this study that no falsification was made on the collected data. "Sakarya University Journal of Education Journal and Editor" had no responsibility for all ethical violations to be encountered, and all responsibility belongs to the authors and that the study was not submitted for evaluation to any other academic publishing environment.