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A Blind Student's Outdoor Science Learning Experience: Barrier Hunting at METU Science and Technology Museum

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Abstract
The aim of this study is about how to adapt the science centers to blind students. For this purpose a barrier hunting methodology is used. This methodology includes seven steps such as selecting the group and place, recording the barriers during the visit and evaluating the recorded barriers. According to the barrier hunting with a blind student at METU Science and Technology Museum, barriers are categorized in six dimensions; access barriers to the area, access barriers to the material, access barriers to the information, safety barriers around the area, safety barriers around the material, and validity problems about the information. These dimensions also present suggestions about how to make the METU Science and Technology Museum more visit friendly.

Keywords: Science Centers, Universal Design, Blind Learners, Barrier Hunting.

Introduction

Science learning is one of the important goals of most recent educational systems due to the needs of scientists in society. In some conditions, schools may not be sufficient to meet this demand. Therefore outdoor learning opportunities are designed for science learners. The increasing number of science centers or museums in the world indicates that science learners from every group of age appreciate this type of flexible learning environments. Due to the fact that science learners may be interested in one subject or want to skip it, the design of science centers or museums let the science learners to make their own choices and learn independently. Opposite to the static and traditional textbooks, science centers provide dynamic and rich environments for science learners. This kind of dynamic and enriched environments is prerequisite for active learning (Jacob, 2012).

Generally science centers should be visitor friendly, open to the interaction and help visitors optimize their own learning (Allen, 2004). Otherwise, the one of the main goals of science centers and museums that is to increase the learners' attitude towards science may not be reached. For instance, a science learner who interests in communication technologies may lose his or her attitude towards the science center where the smallest place is for communication technologies; science learner may think of how the communication technologies are irrelevant to science. Not only there is an effect of science centers on science learners' attitude towards science (Şentürk & Özdemir, 2011) but also there are effects on community (Falk & Needham, 2011) and conceptual development by the help of repeated visits (Anderson et al., 2000). Additionally, science centers are important to change the

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science learners' views about the nature of science owing to the chance to think on science during the science center visits (Rennie & Williams, 2002). However, there may be some ignored groups such as blinds in science centers and all mentioned advantages of science centers become invalid and ineffective for them.

Bülbül (2013a) adapted well-known nature of science activities to blind learners by making them touchable. For instance, with "what is in the box" activity, science learners used all type of data collection methods like swinging the box or using magnets. This kind of tactual activities let the blind learners understand the nature of science; however, in science centers and museums, allowed experiences are limited with the quality of guidance's descriptions. Although blind learners may learn various topics of physics (Bülbül & Eryılmaz, 2012) and develop their science process skills during the out of school activities (Bülbül, 2013b), appropriateness of science centers and museums for blind students is less discussed issue in the literature.

Buyurgan and Demirdelen (2009) explained how a totally blind students' awareness about the subject of visited museum context (The Museum of Anatolian Civilizations) increase by the help of vocal information, touching the reproductions and the copies of some pre-designed art pieces, sensing, answering the inquiry questions and using worksheets. The other study about the same place with different blind students Buyurgan (2009) collected blind visitors' expectations, such as the copies of the works of art, embossed forms of the drawing, and explanations with tactual alphabet. Additionally, Özel (2013) performed the barrier hunting method with a group of students with special needs in a different museum (Maden Teknik Arama, MTA, in Ankara). There were some explanations with Braille alphabet in MTA but the students think that they are not big and clear enough to read. All these observations are precious to understand the needs of blind students during their science center visits.

Problem

This study focused on the experiences of a totally blind university student about the barriers in Middle East Technical University (METU) Science and Technology Museum. Since 2005, the science center in the Science and Technology Museum is one of the most popular science centers with 40,000 visitors per year in Turkey (Şentürk & Özdemir, 2012).

The aim of this study is to determine the barriers in METU Science and Technology Museum for blind users and to find out possible solutions for these barriers. For this purpose barrier hunting methodology is presented and used in the study.

Methodology

Case study method was used in this study since it enables researchers to study complex phenomena within its context (Baxter & Jack, 2008). By explaining barriers for blind learners in METU Science and Technology Museum, and possible solutions recorded there, it was assumed that the case would be explained. This study involves two main parts which are development of the barrier hunting methodology and application of the methodology at METU Science and Technology Museum case.

Development of the Barrier Hunting:

The term "barrier hunting" was first used at a social project which was aiming to detect the physical barriers for disabled people at university campus. After that it was used in several studies such as in the Barrier Hunting activity at MTA museum (Özel, 2013). However, these studies do not specify the steps of barrier hunting. Therefore this study includes basic definition and explanation of barrier hunting methodology. Barrier hunting methodology can not only be used for detecting physical accessibility problems for disabled but also can be used to investigate the needs of any group in any place. For example, the needs of primary school students at a public library can be detected with the barrier hunting methodology. The aim of the barrier hunting is to determine appropriateness of the chosen place to the chosen group; in other words, the aim is to detect the problems that a target group may face while using the target place.

Barrier hunting technique defined in this study consists of seven sequential steps (Figure 1):

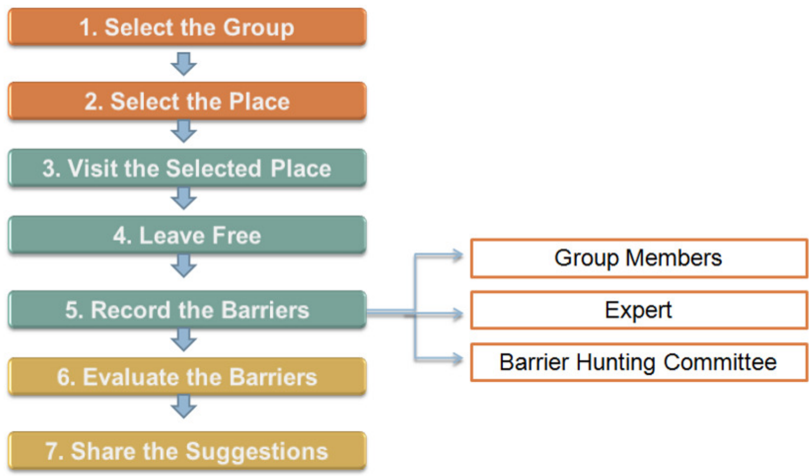

Figure 1. The steps of barrier hunting technique

1. *Select the Group:* In this step the characteristics of the target group is defined by considering the aim and the group members are selected.

2. *Select the Place:* In this step the place where barrier hunting will be conducted is selected.

3. *Visiting the Selected Place:* In this step the selected place is visited with the group members. If necessary the permissions to visit the place should be taken before the visit.

4. *Leave Free:* In this step group members are left free to make observations and detect the barriers. According to the aim of the study and the characteristics of the group, barrier hunting committee may lead the visit or define an outline for it. The group members can make observations in groups or individually according to the characteristics of the group. Committee members may ask questions to them during this step.

5. *Record the Barriers:* In this step every barrier is detected by the group members, expert at the selected place and barrier hunting committee who are out of group members and expert such as teachers or/and principal of school. The barriers may be collected by recording the observations, making interviews and researching the available written sources.

6. *Evaluate the Barriers:* Each noted barriers may not be rational or some of them may be unsolvable. Therefore, in this step, barriers are evaluated and rational and solvable barriers are selected. After that, barrier hunting committee, the group members and field specialists try to find out possible solutions for the selected barriers.

7. *Share the Suggestions:* Suggestions for the possible solutions for the selected barriers are shared with the relevant authority in this step.

The first two steps are the aim defining phase of the study and last two steps are the evaluation phase of the technique. Third, fourth and the fifth steps are the application phase of the technique.

*Barrier Hunting at METU Science and Technology Museum:*The aim of the applied barrier hunting was to determine the problems that blind people may face while visiting science museums. Therefore, the target group was selected as blind users and the target place as METU Science and Technology Museum. This museum consists of four main parts; namely, Science Center, Open Air Collection, Science and Technology History and Transportation History. All the parts were visited with the participant during the barrier hunting activity.

The participant of the study was a 22 years old blind university student. She is studying at history department, but she also is interested in science. She is an active person who participates in EU Projects about disability, takes horse riding courses and participated summer schools abroad. Besides, she generally looks from the different perspective and does not hesitate to share her ideas. These characteristics of her played an important role while choosing the participant. After participant accepted to participate to the study and necessary permissions were taken from the museum, METU Science and Technology Museum was visited.

In the Leave Free step barrier hunting committee which involves the researchers of the study and the participant worked together. However, participant was free to choose how much time she would spend in each part of the museum. Barrier hunting committee asked questions to the participant during the visit. These question-answer parts and the detected barriers were recorded with the audio recorder. A list of barriers was constructed with the blind learner. Besides, the opinions of the museum expert were taken via e-mail conversations. This method is chosen due to the heavy work load of the museum expert. His observations from his experiences were included to the barrier hunting list.

In the Evaluation of the Barriers step the ideas of the participant and barrier hunting committee were used to select rational and solvable barriers. After selecting the barriers, personal experiences and written sources were used to develop a possible solution for each barrier.

Barriers were collected in six dimensions; namely, access barriers to the area, access barriers to the material, access barriers to the information, safety barriers around the area, safety barriers around the material, and validity barriers about the information. These dimensions also present suggestions about how to make the METU Science and Technology Museum more visit friendly.

Findings

In this part of the study, all found barriers with their solutions are given with six main dimensions. All these dimensions include the description, some examples and also possible suggestions for the solution of the problem. It is also possible to unify these six dimensions into three main barriers, namely, barriers about the area, materials, and the information.

1. Access barriers to the area

In this dimension the focus is on the physical accessibility of the area. The difficulties/problems that target group (blind) faces while going to the area (museum) belongs to this dimension. For example, in Figure2 the path to the Science and History part of the museum is shown. As seen in the figure, there is a car just in front of the path and it is a problem for the cane user. Therefore, there is an access barrier to the area. The solution to overcome this barrier may be to remove the car from the path. Also, blind leading lines may be used to make the path clearer.

Figure 2. Car in front of the path cause access barrier to the area

Other access barrier to the area was briars on the visiting area in the Open air Collection part. The solution for this barrier may be removing the briars or making path to the display materials (planes and the locomotive).

2. Access barriers to the material

The difficulties/problems while accessing the materials in the target place (museum) are investigated in this dimension. Two access barriers to the material are shown in Figure 3. When the materials are in display window or behind the safety strip as shown in the figure, blind people do not have a chance to touch and observe the materials. It is obvious that most of the materials in the museums need to be protected and it makes the display window and the safety strip necessary. The solution offered to overcome these barriers is to use touchable models of the displayed material. Besides, audio guides that have detailed descriptions of the materials can be used.

When the material is too big to be able to touch it also presents access barrier to the material for blind users. Big planes in the Open Air Collection part of the museum have this barrier. To overcome the barrier, models of the planes may be displayed near the real plane. Not only blind but also children and other users will benefit from this application by having a chance to touch the plane.

Figure 3. Display window and safety strip cause access material barriers

The participant of the study mentioned that she enjoyed the science center part more than the other parts since she had a chance to touch and observe most of the materials in that part. Therefore, it is important to have access to the material.

3. Access barriers to the information

The accessibility problems of the information about materials or the place are investigated in this dimension. In the Figure 4, the information card about the plane represents an access barrier to the information since the information is not accessible for blind users. It is suggested to write these information cards also with the Braille alphabet to overcome this barrier. The blind participant shared her experience in Germany about a flower museum where she learned the information of any flowers by reading the cards written in Braille. Moreover, audio guides can also be used to make this information accessible for blind users.

Figure 4. Information about the plane on the card is not accessible for a blind user

In the Science and Technology History museum part there were explanations about eras on the wall. These explanations were also presenting access barrier to the information for blind. The above solutions are also valid for this barrier.

As mentioned above hands on activities in the science center part are accessible materials; however they present access barrier to the information. Each hand on activity has explanation cards, but these explanations are not accessible for blind users. Also there are some posters on the walls od Science Center which are not accessible for blind users. The solution for these barriers may be to prepare information cards in Braille or to use audio guides for the activities. Museum specialist mentioned that they make explanations and after that they give free time for the visitors. Blind users can not be independent in the free time if the information of the activities is not accessible for them.

Moreover, there are some materials which do not have any information. For example, there is not any information about some tools (shown in Figure 5) in the Open Air Collection part. Another examples for materials which do not have information can be old phones in Science and Technology History Museum. For some materials in that part there are information cards, but they give the name of the donator and the donation year instead of giving information about the material. Therefore, information about the materials should be accessible for both blind and other users and it should be adequate.

Additionally, some parts of the museum are meaningful for sighted students but difficult for blinds to follow. For example, Science and Technology History Museum were designed parallel to the historical perspective and some rooms are used to demonstrate that part of the history. It is not clear for blinds to understand these rooms and the order. Audio guides may be used to overcome this problem. Audio guides can help blind users to visit the museum in historical order. They will be useful for both blind users and the users who do not know reading or having difficulty of reading.

4. Safety barriers around the area

This dimension deals with the safety problems that members of target group may face while reaching the target place. For example as seen in figure 5 there are some tools in the Open Air Collection area. Users can walk from this area while going from Science and Technology History and Transportation History part to the Science Center part of the museum. Therefore, these tools present safety barriers for blind users.

Figure 5. Tools in the Open Air Collection area and they present safety barriers for blind

5. Safety barriers around the material

Safety problems of the materials in the target place are focused in this dimension. A plane from the Open Air Collection of the museum is shown in Figure 6. As seen in the figure the windows of the plane are broken. It presents safety barrier to the blind user since they make observations by touching the materials. This barrier may be overcome by renewing the windows of the plane.

Figure 6. Broken windows of the plane causes safety barrier to the material

Other example for the safety barrier may be the nails on a material in the science and technology history part. To overcome this barrier there should be some alerts or sharp parts of the nails may be covered with soft materials.

6. Validity barriers about the information

The last dimension is dealing with the validity problems of the information given in the target place. Sometimes the information is accessible but not valid. Validity barrier about the information caused by the improper placement of the information card is shown in Figure 7.

Figure 7. Improper placement of the information card causes barrier

The information card circled in the figure does not belong to the material it is placed. Since the information cards are removable, some users may change the place of the cards and put them on unrelated materials as in this case. Therefore, this barrier may be overcome by making the information cards stable.

Discussion

Generally this study emphasized that there are some accessibility and security problems in the setting of the METU Science and Technology Museum. These barriers also describe the solutions to make the METU Science and Technology Museum more accessible and self-learning system with a secure way. In point of fact, more accessible and more secure places are not necessary only for blinds but also for other visitors. For instance, information about any material with an audio format is not useful for only blind learners but also for illiterate learners. Additionally making the science center or museum more touchable let the learners use more sense and get more experiences. Materials in glass boxes with small and unreadable information only motivate the learner to walk faster and complete the tour in the science center. Quarcoo-Nelson, Buabeng and Osafo (2012) investigated the effect of audio-visual aids on students' physics achievement and due to the positive findings of their experimental study they suggested audio support. In short, making more accessible or diversity in support may help all type of learners.

With a similar perspective, preparation of learners to visit the science center is important (Laçin Şimşek, 2011) and blind learners need this support. At the entrance of the science center, there should be guidance about how to reach the materials and get information by them. This guidance is necessary for not only blind visitors but also foreigner visitors need it. According to the expert in the science center, they introduce the environment at the beginning to the group who got the reservation before and explain the materials before their free-time to perform individually. There is also a map of the METU science center; however, from the entrance to the end of visiting the science learner should be independent. Therefore, there should be some tactual maps and audio explanations about the science center, some tactual and audible directions, and correct information about the material.

Conclusion and Suggestions

Although this study suggest something for barriers in the METU science center, such as making materials, information about materials and places more accessible, findings support the idea that there should be an universal design in science centers and museums. Universal designs should be more flexible and appropriate for as many as possible users (Hitchcock et al., 2002). There are different implications of universal design; such as inclusive education (Silver, Bourke & Strehorn, 1998), adult education (Scott, Mcguire & Shaw, 2003), and e-learning (Pisha & Coyne, 2001). Additionally to these studies, making universal design approach in science centers and museums a current issue is the most important suggestion of this study. Beyond the reached dimensions about the barriers for blind learners in METU science center and museum, the suggestion about performing barrier hunting methodology in different learning environments with different groups is more significant step to make the science for all and universal.

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