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Examining the Effect of Our World Exhibit on Student Visitors: A Science Center Case

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ABSTRACT: This study is about the effect of the Our World exhibit at a science center on student visitors. It elicits students' views about the exhibits, zones, and activities, along with their level of interest and experiences. Data from students (n=346) through a survey, field notes, observations and interviews (n=18) were collected. The findings indicated that curiosity and interest were triggers for visiting the exhibits at the center. Visiting the exhibits helped students acquire science content knowledge. However, limited social interaction was observed among the student groups due to the control of tour guides within a limited period of time. It was concluded that time restriction and crowding played a crucial role in learning about science at the center. It was recommended to allocate more time for free visits, organize smaller group visits, and repair setups under maintenance in order to enhance the effect of the exhibits on students.

KEY WORDS: science center, Our World exhibit, interest, student visitors

INTRODUCTION

Visits to science centers play an important role in complementing school activities, because the experiences offered at the centers are exciting and enjoyable. (Rennie & McClafferty, 1995). Senturk and Ozdemir (2014) agreed with Rennie and McClafferty that visiting science centers had a positive impact on students' attitudes towards science, while Falk and Needham (2011) observed that visits to science centers increased students' interest, curiosity, and attentiveness to science. In this sense, experiencing science through this stimulating medium may change visitors' behaviors associated with science and technology, helping them to feel more informed about science as they engage with the activities. Furthermore, in Jarvis and Pell's (2005) exploration of the various factors influencing students' attitudes toward science and claims that gender,additional experiences gained at a space center, teachers' personal interest in science, adult helpers (i.e., parents, classroom assistants) and teacher behavior (i.e., less recognition of different learning environments)

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were among the factors that played an important role in science enthusiasm and interest in space.

Falk and Dierking (2000), for instance, described science centers within the contextual model of learning, comprising physical, sociocultural, and personal contexts. These contexts were important for the course of a visit and learning outcomes (Schwan et al., 2014). In this respect, the physical context refers to the characteristics of a science center, including exhibit organization and orientation, physical layout, and architectural design. The sociocultural context considers interactions and collaborations within groups at science centers, along with cultural considerations. The personal context comprises visitors' previous knowledge, beliefs, interest, motivations, expectations, and experiences (Falk & Storksdieck, 2005). All of these aspects—*physical*, *sociocultural* and *personal*—are involved in visitors' choices in engaging with the content of a science center (Heimlich & Horr, 2010). Thus, twelve factors within the contextual model of learning are taken into consideration to contribute to the quality of informal learning environments such as science centers. Among these are personal factors (e.g., motivation to visit, expectations, prior knowledge, prior experiences, prior interests, choice and control), sociocultural factors (e.g., within-group social mediation, mediation by others outside the immediate social group) and physical factors (e.g., advance organizers, orientation of the physical space, architecture and large-scale environment, design and exposure to exhibits and programs, subsequent reinforcing events and experiences outside the museum) (Falk & Storksdieck, 2005). In the present study, I explore some of these factors within the contextual model of learning (Falk & Dierking, 2000).

Understanding of the nature and extent of learning in a science center can also be captured through the lens of identity, which may be classified under the categories of explorers, facilitators, professionals/hobbyists, experience seekers, and rechargers (Falk, 2006). In the present study, I classify the study participants as explorers, because they want to explore the content of the *Our World* exhibit at the science center; and they are curiosity-driven through an interest in science.

Research Questions

I asked four research questions to answer in the following;

1- Why did students visit the *Our World* exhibit at a science center?
2- What did the student visitors like/dislike most at the *Our World* exhibit?
3- Which activities did students struggle most to understand?
4- What factors increased the likelihood that students would revisit the *Our World* exhibit?

The section *Results* will focus on answering these questions.

REVIEW OF RELEVANT LITERATURE

The existing studies that explored the nature and effects of informal learning efforts on individuals in the Turkish context are listed here. For instance, a review of the literature revealed that informal learning settings have a positive effect on students' learning processes and the development of skills (Cigrik & Ozkan, 2015; Hakverdi-Can, 2013a; Sahin & Celikkanlı, 2014), students' attitudes toward science (Ates, Ural, & Basbay, 2011;Senturk & Ozdemir, 2014),interest in science and academic achievement (Bozdogan & Yalcın, 2006, 2009; Cavas, 2011), and images of scientists (Leblebicioglu, Metin, Yardimci, & Cetin, 2011).Yet few studies focused specifically on the effects of science centers on students (Ates, Ural, & Basbay, 2011; Bozdogan & Yalcın, 2006, 2009; Cigrik & Ozkan, 2015; Hakverdi-Can, 2013a, 2013b; Senturk & Ozdemir, 2014). Therefore, my contribution to the field is timely and will be invaluable and meaningful for policy makers and educators in understanding and improving the nature of science centers.

Ates, Ural, and Basbay (2011) explored the effects of a science center's activities on students. They worked with 69 middle and high schools to investigate whether an educational program had an influence on visitors and the extent to which it affected them. Their findings indicated that the program helped students to develop positive attitudes toward science. As students were engaged with program activities, they felt comfortable, happy, and peaceful, because the activities offered to them were rich in content, interactive, relevant to daily life, and doable through use of simple materials. In addition, they were engaged with these activities within a social structure comprised of peer interaction, collaboration, and shared responsibility. Likewise, Senturk and Ozdemir (2014) examined the effects of a science center on the attitudes of 251 students aged 11-14 toward science. Their study was limited to measuring the attributes of attitudes towards science, such as learning science in school, self-concept in school science, practical work in school science, science outside of school, future participation in science, and importance of science. They found that visits to a science center increased students' attitudes toward science in a positive manner. However, this effect was not observed with respect to attitudes toward practical work in science. Furthermore, they found that the students' overall attitudes towards science declined just a week after their visit to science center. Therefore, they claimed that maintaining students' positive attitudes towards science may be related to positive science-related experiences.

On the other hand, Cigrik and Ozkan's (2013) study focused on the effect of a science center visit on students' scientific process skills.

They worked with 50 sixth-grade students and observed a significant difference between students who visited the science center many times and those who did not with respect to their scientific process skills. The main reason for this finding was indicated as the nature of the activities offered at the science center. Namely, the hands-on activities provided at the center increased motivation, because these activities were more exploratory and experimental than school science activities. In their study, Bozdogan and Yalcin (2006) investigated the effects of science center exhibits and activities on students' interest and achievement in science. They found that science-related activities and experimental materials had a considerable effect on increasing and maintaining students' interest, because they were able to interact with them in a hands-on fashion, rather than simply reading science content from textbooks and magazines. Moreover, they observed that visits to a science center supported students' achievement in science, as they were engaged with materials through experimental setups. In a related project, Bozdogan and Yalcin (2009) observed the effects of exhibits and activities at another science center on learners' interest and achievement in science. While the findings were similar, they found no meaningful relationship between science achievement and interest in science.

Similarly, Hakverdi-Can (2013a) explored the effects of 48 experimental activities at a science center on primary school students. She found that most of the students gained more content knowledge, and they preferred to engage with activities that were entertaining and interactive. Furthermore, male students preferred the interactive and hands-on activities more than female students. However, students disliked some activities that required higher-order thinking, because these were difficult to understand. In another study, Hakverdi-Can (2013b) examined the behaviors of 63 students visiting a science center without a tour guide. She looked at the participant structures of the students, such as passive observer, passive reader, passive participant, passive engagement, active engagement, and non-participant. She observed that 43.22 % of the students were actively engaged with the activities at the center; only 18.6% were passive observers and participants. A driver reaction test that simulated the experience of driving a car was the most visited activity among the students; they also liked hands-on activities such as the aerodynamic bicycle and bike generator. A shadow tunnel and plasma ball were preferred by female students, whereas the male students in the study were more interested in the driver reaction test, bike generator, and the "little world" exhibit. While they were engaged with activities, the discourse of the students involved their curiosity, experimentation, and their ability to do the activities.

In sum, several studies concerning the effects of science centers on visitors have focused on skills related to the scientific process, attitudes

towards science, and science achievement in the Turkish context. A limited number of studies investigated the effects of activities and exhibits on science center visitors from a more specific perspective. As with Ates et al. (2011) and Hakverdi-Can (2013a, b), I aimed to further examine the effects of the Our World exhibit at a science center on student visitors by eliciting their views about the exhibits, zones, and activities, along with their level of interest and experiences. To achieve the aim of this study, I was interested in exploring the reasons that students visited the Our World exhibit; examining the nature of the activities that students liked, disliked, or struggled to understand; and uncovering factors that played a role in a desire to revisit the exhibit.

METHODS

Setting and Content

The setting for this investigation was the "Our World [OW]" exhibit at a science center in Turkey. The exhibit takes visitors on a journey that explores our complex planet and the environmental diversity of the local Anatolian region, as well as natural resources and renewable energy sources. The OW exhibit consists of three zones: (1) Global Forces: Ever-Changing Earth, (2) Anatolian Geography, and (3) Human Footprint: Managing Our Resources. There are also several sub-zones, with 37 different activities. Included among the sub-zones are Formation, Structure and Plate Tectonics; Life Emerges and Evolves; Weather and Climate; Hydrology and the Distribution of Water on Earth; Ecosystems; Geological Features; Earth-Human Relationships; Energy Resources: Today and Tomorrow; and Water Resources. The activities were classified according to two categories: geology zone and energy zone.

The OW exhibit was designed to provide visitors with a holistic experience through the activities, which were characterized as open-ended (6 activities; 16%), iconic (6 activities; 16%), and multi-user (18 activities; 49%) in nature. In addition, visitors were expected to gain experience through various media such as mechanical (7 activities; 19%), electro-mechanical (22 activities; 59%), media table (3 activities; 8%), media kiosk (9 activities; 24%), and environmental (7 activities; 19%).

During the course of this study, schools or student groups came to take a journey through the exhibits by appointment, along with their teacher. The groups had a tour guide; and each journey depended on the tour guide's preference in terms of his or her or his background and interest in the activities in each zone. For instance, if a tour guide had background knowledge and greater interest in Anatolian Geography, visitors would take a journey through the Karst Caves and Sinkholes. If not, they would probably visit other activities in the respective zones. Most of the tour guides took students on journeys through activities that

were more interesting and relevant, such as Mosasaur; or those that were closely associated with their daily lives, such as Personal Water Consumption; or more interactive activities such as the Watershed Table (Hydrology), Wind Energy, Shake Platform and Jump Seismography. Each journey lasted thirty minutes. The tour guides allocated twenty minutes to giving information about the OW exhibit and raising rhetorical questions. The remaining time of the visit was a free period for students, who could then individually drop by each activity in the zones to use the touchscreen kiosks, read information, make experiments, and play.

Study Participants

For my inquiry, I collected data from students (n=346) in March, 2015. These students were grouped according to gender, as well as two separate age groups: 9-12 years (n=167; 48.26 %) and 13-15 years (n=179; 51, 74 %).

Data Collection and Analysis

In order to answer the research questions: 'Why did students visit the Our World exhibit at a science center?', 'What did the student visitors like/dislike most at the Our World exhibit?', 'Which activities did students struggle most to understand?' and 'What factors increased the likelihood that students would revisit the Our World exhibit?' Data were collected using a survey, observations, and interviews. The survey explored the demographic information about the students, as well as their interest levels, views about the exhibit, expectations from the exhibit, reasons to visit or revisit or not to visit, views about the interactive setups at the exhibit, and recommendations for the exhibit.

I conducted comprehensive observations during student visits. My observations lasted for nine days, from 10:00 am until 5:00 pm, in March, 2015. This time period was the visit time for the student groups with teachers who had requested a tour guide from the administration of the science center. In addition, I interviewed 18 middle school students (coded as S1 through S18), aged 11-14 years, to obtain insights about the OW exhibit. The interviews were conducted with pairs of students due to their availability. I was not able to interview high school students due to their availability. While I asked questions that paralleled those in the survey, I also encouraged the interviewees to provide me with some details about their visit. Each interview lasted 15-20 minutes. I audio-recorded each interview and transcribed them verbatim.

I obtained the frequencies associated with (1) reasons to visit the OW exhibit, (2) students' views about the exhibit and activities, and (3) reasons for revisiting the exhibit. After transcribing the interview data verbatim, I evaluated the students' comments and statements alongside their responses to the exhibit survey. The interview questions, which were

associated with the research questions, asked the students to express their views about the OW exhibit and its activities, as well as their experiences during their visit and reasons for revisiting the exhibit. I analyzed their responses using the constant-comparative method (Glaser & Strauss, 1967), interpreting the students' comments and views from sociocultural perspectives. The interview data were examined in consideration of research questions, along with the students' responses to the survey, and I determined whether their responses were associated with the study purpose.

To establish trustworthiness of the study, I used in-depth and detailed descriptions of my observations during the course of my inquiry. These observations focused on the mutual interactions among the student groups, their comments and questions, and their behaviors and attitudes during the tours. I triangulated the findings from the interviews with survey and observations (Creswell, 2013). Then, I established dependability using peer debriefing to control the collected data and findings. A researcher with specialization in science center was invited to the peer debriefing sessions (Lincoln & Guba, 1985). These sessions consisted of conversations and question-answer periods. She evaluated the purpose of the study, research questions, and findings concerning how well the data supported them. She was selected for peer briefing because she was familiar with science center activities and had experience with children at aged 11-14 years.

RESULTS

The characteristics of the OW exhibit and its activities

To explore the effects of the OW exhibit and its activities, I asked the student visitors what they thought about the OW exhibit in general, along with its activities, in more detail. In this respect, I observed that the exhibit was mostly entertaining (n=190), interesting (n=192), and thought-provoking (n=115). For examples, S2 defined the nature of the exhibit as follows: "I cannot stop thinking of the Continental Puzzle activity and the Water Cycle activity. I found answers to the questions in my mind. [It] should not be concrete, right? The OW exhibit was good and entertaining and interesting." In line with S2, S5 found that the OW exhibit was entertaining. As she expressed, "the OW exhibit has electronics and scientific experiments about nature. You do [the applications] by yourself." Moreover, S12 told us that, "[the OW exhibit] was not boring, because [a tour guide] explained the concepts with examples. It was entertaining, and at the same time, we were learning. So we did not get bored at all."

I can claim that the exhibit was entertaining, interesting and thought-provoking, because it has varied activities that are rich in content

and interactive. The responses to the survey and interviews indicated that, among the 37 activities, the students liked the Jump Seismograph, Climate Chambers, Shake Platform, Wind Power, Solar Power, and Personal Water Consumption the most. The Shake Platform and Climate Chambers were activities through which students were able to experience natural phenomena; namely, they learned by doing. For example, the Shake Platform was explained to the students by a tour guide, who lectured them about earthquakes and what to when a quake occurs. Then the activity simulated a real quake, allowing students to feel it for themselves. After going through this simulation, S8 mentioned that "I liked the Shake Platform, because a quake is what I feared most when it happened in my home town. I experienced it again here and had some knowledge about it. I would not have been afraid of it if I had experienced it before." As with S8, S6 commented that "I liked the Shake Platform; it was different and interesting to me. I liked that it was very real to me."

Likewise, students enjoyed the Climate Chambers, because they could feel the different temperatures of various climates—cold, hot, and warm – and could feel as if they lived in such climates. As S14 stated, "I liked the tropical climate, because I observed the forest theme and voices from Mother Nature." Like S14, S18 mentioned that "I heard the voices of birds, which I liked." On the other hand, S15 and S17 liked the polar climate "because it was cold and fresh."

In contrast, some of the students disliked certain activities at the OW exhibit, such as the Wind Power and Helicopter Eco-Tour/Geography of Turkey. This was because some visitors were unable to use the Wind Power and Helicopter Eco-Tour/Geography of Turkey setups as they were intended, as they were under maintenance. Namely, as S7 stated, "[I did not like Wind Power setup] because I could not figure out what's going on. It was under maintenance. I might have liked it, but it did not work." Additionally, S18 mentioned that "I did not like the Helicopter [Eco-Tour], because it was not interesting to me. I do not think that I learned anything from it." Moreover, some students did not like the Shake Platform because it was not realistic to them. Likewise, S10 stated that she did not like the Volcanoes activity because it was not realistic. She added that "there were some buttons on the setup of the Volcanoes activity that I pushed, but it was not very real. I would expect to hear the sound of explosions, but there was no sound at all." Moreover, there was a model of a Mosasaur, which was designed to attract visitors' attention because the Mosasaur had lived in a city thousands of years ago. The Mosasaur robot aimed to create a bridge between the past and present. However, as S9 stated, "The Mosasaur was an unnecessary part of the OW exhibit. It was moving as if it saw us. I do not think it was useful for us; so I did not like it."

Interest and curiosity as a trigger to visit the OW exhibit

In terms of why students wanted to visit the OW exhibit at the science center, we found that the most common among the reasons given by the students (n=346) included "interest in the OW concept," (n=241) and curiosity (n=236). Secondly, recommendations from their science teachers (n=135), parents, and friends (n=87) encouraged them to visit; and in addition, news and television programs about OW (n=65) sparked their interest and led them to visit the exhibit. Requests from school administration (n=39) were a further reason to visit.

In eliciting the students 'views and expressions, the interview data indicated that their personal expressions were aligned with the frequencies found in the survey data. For instance, "Interest in the OW concept" and curiosity prompted them to visit the OW exhibit. As S7 and S12 expressed in their interview, "In our school, there is a project that aims to encourage positive behavior development. Successful students are selected weekly and monthly. These students are given an opportunity to go to the theater, have lunch outside the school, or visit the Science Center. We chose to go to the center [because we were curious about science]." In line with S7 and S12, S1 stated that she went to the science center because she was very curious about it. Likewise, as S3 added, "I had been at [the Science Center] before, and at that time, I was very curious, as I am now." Some of the other students' views were expressed as follows:

> I was very curious. I have kept asking my teachers questions about the OW [exhibit]. (S4)
>
> I wanted to learn something about science; for instance, the layers of our earth. (S5)
>
> Everyone recommended that I visit the OW exhibit at [the science center]. I am curious about science, as I am a curious person…I had visited the exhibit with my family before. The first time, I could not figure out the OW exhibit. (S13)

From these excerpts, we understand that some of the students had been rewarded with a visit to the OW exhibit because of their attitude and behavior in class. Because these students were interested in and curious about science, they chose to visit the OW exhibit at the Science Center. In other words, the students' responses in both the survey and the interviews indicated their interest, and their curiosity prompted them to visit the OW exhibit at the science center.

Reasons for re-visiting the OW exhibit

In this section, I explored some of the reasons for students' wishes to revisit the OW exhibit. Our findings indicated that 96.85% of the students were willing to return to visit the exhibit again, while only 3.15% did not want to return. To detail the reasons that students wanted to revisit, we asked about this topic in the interviews. The most common among the

reasons given were curiosity, time restriction, crowding, and setups under maintenance.

Some of the students reported that after their first visit, they wanted to return, because they were still curious about the phenomena represented through the activities or setups or models. For instance, as S1 remarked, "I want to revisit the exhibit with my family this weekend. I liked it because this is our world that we live in." Likewise, S17 expressed that "there are very interesting things [at the exhibit]. I am very curious about them. I would like to see them again."

I realized that some of the students who were curious in fact did not have enough time to visit the exhibit as intended. There were thirty-seven activities in the exhibit, but they had limited time due to the large group sizes. Because this restricted their ability to explore the exhibit thoroughly, a revisit was necessary for the curious students. In reference to this issue, S4 stated that "we visited the exhibit with other student groups, and I could not see some parts of the exhibit. For instance, at Layers of Earth, there is magma, and we could see how it is hot because we could stand on it. There is no heating system, so how is it hot? I have such questions in my mind, and I would like to answer them." Similarly, S16 added that "there was a time restriction, and I needed more time, but we were told to leave immediately [after a visit with a guide]. Because of my friends [as a group we were crowded], I could not see the exhibit as intended. My friends blocked me from doing so." Likewise, S14 reported that "[I want to revisit] because it was very crowded. I do not think I understood everything."

During the course of my inquiry, I observed that some of the activities or setups -- Solar Power, Helicopter Eco-Tour, Wind Power, and Karst Caves -- were under maintenance. Such activities were interactive and intriguing to students, but they were unable to engage with them due to the repairs. As such, I anticipated that this was another reason behind their wish to revisit the exhibit.

Comparisons associated with the effects of the OW exhibit on student visitors

I performed comparisons associated with the effect of OW exhibit on student groups. Our continuous dependent variables were: (a) Density in visiting zones and activities at the exhibit, (b) Perceptions of difficulty at the exhibit, (c) Eagerness for further information at the exhibit. In detail, density in visiting zones and activities at the exhibit is associated with students' preferences in visiting the relevant zone. Perceptions of difficulty refers to students' struggle with a specific activity at the exhibit. Eagerness for further information at the exhibit is a willing to learn more about the exhibit and its activities. Independent grouping variables included gender and age.

Effects of gender

I observed only the effect of gender on dependent variables—density in visiting zones, perceptions of difficulty, and eagerness for further information at the exhibit. I found that male students outperformed female students in preferences for visiting zones and activities at the exhibit ($p<.05$; Cohen's $d=0.24$).I also found that male students perceived more difficulty than female students ($p<.05$; Cohen's $d=0.24$). This indicates that the male students had more difficulty in understanding the concepts and content of the exhibit. However, there was no statistically significant difference between male and female students in regard to eagerness for further information ($p>.05$; Cohen's $d= 0.17$).

Comparisons associated with the energy zone

I investigated activities under the Energy Zone at the exhibit, including Wind Power, Solar Power, Geothermal Energy, Nuclear Energy, Bio-fuels, and Energy in the City. I found that there was a statistically significant difference between male and female students in terms of perception of difficulty in the energy activities at the exhibit ($p=.048$; Cohen's $d=0.22$). This indicates that the male students struggled more with understanding the energy activities than the female students. In addition, there was a statistically significant difference between the male and female students ($p=.032$; Cohen's $d=0.24$) in terms of eagerness for more information about the energy activities. This finding means that the male students were more willing to learn about the energy activities than the female students.

Comparisons associated with the geology zone

I investigated the activities found in the geology zone at the exhibit, such as Layers of the Earth, Continental Puzzle, Shake Platform, Jump Seismograph, Volcanoes, Mosasaur, Sinkholes, Salt Lakes, and Sand Dunes/Aeolian Landscape. In exploring the students' perceptions in terms of difficulty in understanding the geology activities with reference to gender, I only found a statistically significant difference between male and female students ($p=.013$; Cohen's $d=0.27$). This shows that the male students reported more difficulty in understanding the geology activities than the female students.

To summarize, these two sets of findings are important in terms of my exploration on the effects of the energy and geology activities. First, I found that the male students visited the energy-related activities at the exhibit more often, combined with a perception of difficulty that motivated them to want to learn more about energy concepts. Second, I surprisingly witnessed that the male students showed more preference for visiting the geology zone, with a greater perception of difficulty, in comparison with the female students. This finding allowed me to

conceptualize that the male students had greater eagerness for further information about the geology activities.

DISCUSSION

The present study has highlighted a variety of issues concerning the effects of the OW exhibit on student visitors. For instance, the findings explicitly revealed that curiosity and interest are triggers for visiting the OW exhibit at the science center. This result is consistent with the findings in the literature (e.g., Falk, 2006; Falk & Dierking, 2000). In this respect, Falk (2006) conceived of visitors as explorers, because explorers are driven by curiosity; they are science lovers and learners. Likewise, the study participants chose to visit the science center to learn science due to their interest and curiosity. Furthermore, within the contextual model of learning, prior knowledge, prior experience, and prior interest have been cited among the personal motivational factors concerning visiting science centers (Falk & Dierking, 2006). These factors were also observed in the current study, as some of the interviewees indicated that they had prior experience with the OW exhibit at the science center, and most of them had some knowledge about and interest in the OW concept. Therefore, it can be stated that prior experience, prior interest, and prior knowledge were factors that played an important role in stimulating visits to the exhibit at the center.

In addition, the study findings indicated that visiting the OW exhibit helped students acquire science content knowledge. Although they were escorted by a tour guide, they had some free time to use the touch screen kiosks, read, and play with the materials provided at the exhibit. Moreover, most of them came to the science center with some knowledge about the OW concept. Few of the students reported having no knowledge at all about the OW concept before their visit; and most of the students indicated that they learned something about the exhibit during their visit. This result is in harmony with the finding that visits to science centers are a means for gaining science content knowledge(Ates, Ural, & Basbay, 2011; Falk & Storksdieck, 2005; Hakverdi-Can, 2013a, b; Jarvis et al., 2005; Sahin & Celikkanlı, 2014).

A study by Jarvis et al. (2005) found that students met with quality learning time at a space center, because their group leaders encouraged them to raise questions and read information. This finding is consistent with observations that certain tour guides prompted the students to think about rhetorical questions. This approach aimed to engage students with a relevant topic and gain some knowledge about it. Furthermore, Hakverdi-Can (2013a) conceived of science centers as settings where visitors learn about science and develop skills by exploring the relationship between dependent and independent variables. In line

with this finding, I observed that the student visitors engaged with experiments in which they were able to change parameters (i.e., variables) to understand the related natural phenomenon (e.g., energy transformations in the Wind Power activity).

Other researchers have provided evidence that science centers offer opportunities for visitors to learn (Falk & Storksdieck, 2005; Luehmann, 2009; Rennie et al., 2003; Tali Tal, 2006). In this regard, Falk and Storksdieck (2005) defined opportunities, or factors, within personal, sociocultural, and physical contexts. For instance, group social interaction was a factor that influenced learning within sociocultural context (Rennie, Feher, Dierking, & Falk, 2003; Rickinson et al., 2004). Consistent with this idea, social interaction in the current study was observed among the student groups. Although they had come to visit the exhibit as a whole class, they took a journey through the activities within groups; however, such interactions were limited because their visit was controlled by the tour guide over a limited period of time, with insufficient opportunities to spontaneously interact with the exhibit. A similar finding was observed in another study by Hakverdi-Can (2013b), who found that student visitors tended to skip activities that required high level thinking due to the restricted time. In addition, I accept that learning occurs in physical environment, and in this case, I observed that the physical environment was crowded. According to Falk and Storksdieck (2005), crowding is a factor that may affect learning, as it may cause student visitors to miss some of the activities at an exhibit (Falk & Storksdieck, 2005). This result is consistent with our finding that the visitors experienced crowding, which in turn played an important role in their desire to return.

I also explored the effects of the OW exhibit on student visitors by eliciting its characteristics, which were grounded in the activities offered at the exhibit. In doing so, I observed that the activities could be classified as open-ended, iconic and multi-user in nature. Along with these features, visitors were expected to engage with the activities through different media, such as mechanical, electro-mechanical, media table, media kiosk, and environmental formats. The nature of the activities allowed students to evaluate the OW exhibit as entertaining, interesting, and thought-provoking (DeWitt & Osborne, 2010). This outcome can be associated with the physical context represented in the contextual model of learning (Falk & Dierking, 2000), because physical context refers to the design of an exhibit, including the types of activities available (Jarvis et al., 2005). In my case, I observed that some of the student visitors liked the activities offered at the exhibit due to their richness of content and interactivity, which enabled them to experience the natural phenomena in a realistic manner (Ates et al., 2011; DeWitt & Osborne, 2010). On the other hand, some because of the students did not like certain activities that were under maintenance. Thus, to improve the impact of the exhibit on

visitors, the physical context addressing the availability of activities (or setups) should be considered in order to allow visitors to acquire scientific content knowledge and skills.

In addition, there was evidence that the student visitors were willing to revisit the OW exhibit due to their curiosity; therefore, we added curiosity to the personal context (Falk & Dierking, 2000) and accepted our study participants as explorers who were driven by curiosity (Falk, 2006). This finding was in harmony with the study finding that curiosity prompted the participants to visit the OW exhibit. Curiosity was in their nature, yet time restrictions and crowding restricted their visit and limited their ability to engage with the activities as intended. However, in line with researchers, who assert that a visit to an exhibit at a science center was a means for enhancing curiosity (Bell, Lewenstein, Shouse, & Fedler, 2009; Falk & Needham, 2011; Rennie & McClafferty, 1995; Sahin & Celikkanli, 2014), I found that time restrictions and crowding were factors motivating plans to revisit the OW exhibit, in addition to their negative impact on learning (Falk & Storksdieck, 2005).

According to Jarvis and Pell (2005), gender is a factor that plays an important role in science enthusiasm and interest in space. On the other hand, Jarvis and Pell (2002a) found that both boys and girls like the practical, hands-on aspects of science learning (Cigrik & Ozkan, 2013; Jarvis & Pell, 2002a; Senturk & Ozdemir, 2014). In line with these studies, I found in the present study that the male students visited the energy and geology zone activities more often than the female students. More explicitly, we observed that the activities in both zones were rich in content and interactive (Ates et al., 2011; Hakverdi-Can, 2013a), and the activities such as Wind Power, Solar Hockey, Shake Platform, Volcanoes, and Jump Seismograph were more practical and hands-on in nature (Senturk & Ozdemir, 2014). However, there was evidence that although the male students visited these activities more frequently, they had a greater preference to revisit them, because they had more difficulty in understanding the content in these activities. I associated the reason for wanting to revisit the exhibit with the time restriction (Falk & Storksdieck, 2005; Hakverdi-Can, 2013b), which in turn led the students to become more eager for further information about the energy and geology zones. This result resonated with the correlations among the variables. In other words, the students who visited the activities more often met with difficulty in understanding the science concepts, but this difficulty did not prevent them from wanting to learn more. Instead, they showed greater eagerness for further information about the exhibit.

CONCLUSION

In this study, I sought to answer the questions:
(a) why did student visitors visit the Our World exhibit at the science center?
(b) What did the student visitors like/dislike most at the Our World exhibit?
(c) Which activities did the students struggle to understand most? and
(d) What were the factors motivating a wish to revisit the Our World exhibit ?
Similar to the findings of numerous other studies (Ates, Ural, & Basbay, 2011; DeWitt & Osborne, 2010; Falk, 2006; Falk & Dierking, 2000; Falk & Storksdieck, 2005; Hakverdi-Can, 2013a,b; Jarvis et al., 2005; Sahin & Celikkanlı, 2014; Storksdieck, Ellenbogen, & Heimlich, 2005), this study also provided confirmatory evidence for the argument that exhibits at science centers have a positive impact on students. The first conclusion was that interest and curiosity were motivational factors for students to visit the OW exhibit. Second, student visitors learned more about the science topics at the OW exhibit because the activities offered were rich in content, interactive, practical, and hands-on in nature. Third, they were more willing to revisit the exhibit due to curiosity, time restrictions on the initial visit, crowding, and maintenance on certain setups. Time restrictions and crowding played a crucial role in learning about science, as well. In this regard, the study findings indicated that time restriction did not allow students to spend sufficient time in understanding the activities that required a higher level of thinking. Hence, the students demonstrated more eagerness for further information about the exhibit. Crowding was also a factor prompting a wish to revisit the exhibit. However, students in large groups visited the exhibit under a tour guide's control by appointments made by their teachers or school administrators; we had to follow their instructions while participating in the journeys at the exhibit. Fourth, more interestingly, I found that the male students who indicated a greater preference for visiting the more interactive, practical and hands-on activities had greater difficulty in understanding natural phenomena (e.g., energy and geology concepts), which in turn led them to revisit the exhibit to learn more about science content. I associated this outcome with factors such as time restrictions and crowding. Fifth, I observed that some of the setups were under maintenance during the course of inquiry. Although in this case, this provided a reason for students to revisit, this could also be a factor in discouraging them to return.

There is no doubt that visiting OW exhibit at the science center has a potential in enhancing student visitors' interest and curiosity in science, their knowledge and insights about OW concepts. However, to increase the effect of the exhibit on student visitors, there is need to allocate more time for free visits, organize smaller group visits, and repair setups under maintenance.

In this study, I did not aim to investigate how the content and purpose of OW exhibit align with school science learning objectives, but feedback from student visitors that I interviewed indicated that they were familiar with OW related concepts and they had experienced with similar concepts in their class. However, they met similar concepts through hands-on and minds-on activities at the science center. Therefore, visiting OW exhibit provided them with the opportunity to learn OW concepts in theory and practice.

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