Hacettepe Üniversitesi Eğitim Fakültesi Dergisi (H. U. Journal of Education) 30(1): 178-194 [Ocak 2015]

Assessing the Learning Environment in Science and Technology Course Based on Constructivism

Fen ve Teknoloji Dersindeki Öğrenme Ortamının Yapılandırmacılığa Dayalı Olarak Değerlendirilmesi

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ABSTRACT: The aim of this study was to investigate fifth grade students' opinions about the learning environments in science and technology courses based on several variables in relation to constructivism. The study was designed based on a survey method. The Constructivist Learning Environment Scale was used as the data collection tool. Arithmetic means, standard deviations, percentage calculations, t-tests and an ANOVA were used in the statistical data analysis. The findings from this study revealed that the fifth grade students regarded learning environments in the science and technology courses to be constructivist at or above a medium level. It was further determined that the students' opinions about learning environments in science and technology courses did not differentiate according to gender, the number of Science and Technology textbooks in their homes or the educational backgrounds of the students' mothers. On the other hand, a positive differentiate was identified between the educational backgrounds of the students' fathers and the students' opinions about learning environments in science and technology courses. It was also found that learning environments that were aligned with real life, well-equipped homes and school environments had a positive influence on the students' opinions regarding learning environments.
Keywords: Constructivism, Constructivist Learning Environment, Science and Technology Instruction

ÖZ: Bu çalışmada, ilköğretim beşinci sınıfta öğrenim gören öğrencilerin fen ve teknoloji dersindeki öğrenme ortamlarını yapılandırmacılık açısından değerlendirmelerinin çeşitli değişkenler açısından incelenmesi amaçlanmıştır. Çalışma, tarama modeline dayalı olarak desenlenmiştir. Araştırma verileri, beşinci sınıf öğrencilerinden toplanmıştır. Araştırmada veri toplama aracı olarak "Yapılandırmacı Öğrenme Ortamı Ölçeği" kullanılmıştır. İstatistiksel veri analizinde aritmetik ortalama, standart sapma, yüzde hesaplamaları, t-testi ve ANOVA kullanılmıştır. Araştırma sonuçlarına göre; ilköğretim beşinci sınıf öğrencilerinin Fen ve Teknoloji dersindeki öğrenme ortamlarını orta düzeyin üzerinde yapılandırmacı olarak değerlendirdiği ortaya çıkmıştır. Öğrencilerin Fen ve Teknoloji dersindeki öğrenme ortamlarına yönelik görüşleri ile baba eğitim düzeyleri arasında pozitif yönde farklılık olduğu görülmüştür. Öğrencilerin öğrenme ortamlarının gerçek yaşama dönük olması ile ev ve okul ortamlarının zengin olmasının öğrenme ortamlarına yönelik görüşlerini olumlu düzeyde değiştirdiği belirlenmiştir.
Anahtar sözcükler: Yapılandırmacılık, Yapılandırmacı Öğrenme Ortamı, Fen ve Teknoloji Öğretimi.

1. INTRODUCTION

In the 21st century, the new purpose of education is to create individuals who construct new knowledge by using previous knowledge, who are aware of when and where to use this new information, who know how to access knowledge and who are capable of solving problems using their newly acquired knowledge and skills. To meet this goal, it is necessary to modify the teaching and learning practices in science and technology courses just as it is in all other education programs. In Turkey the curriculum of the science and technology course was based on the student-centered constructivist approach. According to the constructivist learning theory, an individual forms his own knowledge based on his own experiences. This knowledge reflects more than just that which was learned. Based on this approach, individuals formulate meanings throughout the learning process, and in this way, the individual assumes responsibility for his

[*] This manuscript is a part of the first author's master thesis, completed with supervision of second and third author

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own learning (Schneider, Krajcik, Marx & Soloway, 2002; Staver, 1998). Individual's associate knowledge gained with older knowledge and construct new knowledge (Seatter, 2003; Özden, 1999). Designing constructivist learning environments have undergone remarkable growth, diversification and internationalization during past 30 years (Fraser, 1998a). Although the study of learning environments grew out in the USA starting from 1920's and the Western countries, especially in Netherlands (Fraser 1986, 1994, 1998b, 2002, 2007; Fraser & Walberg, 1991; Wubbels & Brekelmans 1997, 1998, 2006; Wubbels & Levy 1993). African (Aldridge, Laugksch & Fraser, 2006; Fraser, Okebukola & Jegede, 1992) and Asian researchers (Aldridge, Fraser & Huang, 1999; Goh & Fraser 1998; Goh & Khine, 2002; Khoo & Fraser 2008; Kim, Fisher & Fraser, 2000; Lee, Fraser & Fisher, 2003; Koul & Fisher 2005; Quek, Wong & Fraser, 2005; Wanpen & Fisher 2006) have made distinctive contributions to the learning environments research area (Anagün and Anılan, 2013). Constructivist learning environments are designed to motivate students as they learn and to encourage students to focus on the issue. The teacher and student decide together what this process would entail (Karadağ and Korkmaz, 2007). Education settings where the constructivist approach is followed require that individuals assume more responsibility and be effective in the learning process because constructs with regards to the elements to be taught must be realized by the individual himself. Therefore, constructivist education settings should be arranged in such a way that they allow students to interact and have rich experiences. (Yaşar, 1998).

Aldridge et al. (2000) determined that constructivist learning was examined differently in the literature and divided the environments into five sub-dimensions. These dimensions include (i) personal relevance, (ii) scientific uncertainty, (iii) critical voice, (iv) shared control, and (v) student negotiation

Personal Relevance: measures the extent to which teachers' associate science with outside experiences. Constructivism interested in teachers making use of students' everyday experiences as a meaningful context for the development of students' scientific knowledge.

Scientific uncertainty: reflects the constructivist structure of scientific knowledge. This dimension measures what opportunities are offered to students that will promote the acquisition of scientific knowledge.

Shared control means that students share control of the learning environment with their teachers, and they participate in planning their own learning activities.

Critical voice includes students' thoughts about the social environment within the classroom and the teacher's approach toward teaching the material.

Student agreement refers to the level of communication among students such that those students listen to each other and they are free to explain and defend their own ideas. It is the communication among students

The science and technology course curriculum designed based on the principles of constructivism, assign teachers and students new responsibilities and roles. The design of learning environment is one of the most important factors for implementing the curriculum effectively. The success of Science and Technology curriculum in Turkey depends on the researches which are examining learning environments deeply. Students' views about their learning environments may direct teachers' arrangements. That's why it's important to know students' opinions.

Problem Statement: What are the opinions of fifth grade students about the learning environment of their science and technology course and do these opinions differ with respect to certain variables?

Sub-problems:

1) What do fifth grade students think about the learning environment of their in science and technology course?

2) Do the opinions of fifth grade students regarding the learning environment of their in science and technology class differ with respect to gender, parents' education level, school facilities, classroom tools, home opportunities, the number of books about science and technology at home, the frequency of watching science and technology relevant television shows during their science and technology class, number of opportunities relevant to science education outside the school and the frequency of conducting science and technology course outside the school?

2. METHOD

A survey method was adopted for this study. The survey method is a research approach aimed to describe current or past situations. As such, the approach seeks to describe the subject event or individual within the conditions under which they exist (Karasar, 1999).

2.1. Population – Sample

The population of this study was fifth grade students attending to 20 public and one private elementary school in the middle region of Turkey. Because the whole population was accessible for the study, a sample was not selected. All 1074 elementary school fifth grade students were included in the study. However, only 696 students participated due to the following reasons. One of the school principals did not approve of the study and therefore did not allow his school to participate, some students were not present on the day the data were collected and surveys that contained mistakes or were incomplete, were removed from the study.

2.2. Data Collection Instrument

The data collection instrument was a survey that consisted of two sections. The first section gathered data related to personal information of the students, properties of the learning environment, and opportunities offered the students. The second section included the Constructivist Learning Environment scale by which students assessed the learning environment of their science and technology course. The Constructivist Learning Environment scale, the original of which was developed by Aldridge et al. (2000) and then adapted to Turkish, was used. The scale was adapted for fifth grade level students by Anagün and Anılan (2010) and it was found that the structure of the original scale which was composed of five sub-factors was retained same. To control the reliability of the scale used in present research, the internal-consistency coefficient was calculated. The Cronbach alpha value of the scale was found 0.82.

2.3. Data Analysis and Interpretation

To facilitate an analysis of the scale, classroom instruments and tools were grouped as visual materials (projection, video, television, computer, models and educational software about science and technology) and written materials (books and magazines about science and technology); instruments at home were grouped as having one's own room , visual materials (computer, Internet, DVD player, microscope, models and educational software about science and technology) and written materials (books and magazines about science and technology). The arithmetic mean, standard deviation, frequency, percentage calculations, t-test calculations, Tukey and ANOVA tests were conducted. The t-test was performed to determine whether fifth grade student opinions regarding science and technology course learning environments varied. Additionally, Tukey and ANOVA tests were conducted to determine whether there was a significant difference among students' opinions about their science and technology course learning environments with respect to parents' level of education, opportunities in school, tools offered in the school environment, opportunities at home, number of books at home related to science and technology, frequency of watching television shows related to science and technology and the frequency of conducting science and technology course outside the school.

3. FINDINGS

3.1. Findings Regarding the First Sub-problem

Arithmetic mean, frequency, percentage and standard deviation were calculated for the first sub-problem: "What do fifth grade students think about the learning environment of their in science and technology class?" The results are presented in Table 1.

Table 1: Mean and Standard Deviation Values for the Constructivist Learning Environment

Factors	ITEMS	$\bar{X}$	*SS*
Personel relevance	I learn about the world outside of school.	4.21	1.06
	My new learning starts with problems about the world outside of school.	3.53	1.33
	I get a better understanding of the world outside of school.	3.98	1.17
	I learn interesting things about the world outside of school.	3.90	1.11
Scientific uncertainty	I learn that science has changed over time.	3.99	1.61
	I learn that science is influenced by people's values and opinions.	3.89	1.17
	I learn about science used by people in other cultures	3.70	1.21
	I learn that science aims creating theories or new ideas.	3.88	1.23
Critical voice	It's OK for me to ask the teacher "Why do I have to learn this?"	3.49	2.43
	It's OK for me to question the way I'm being taught.	3.42	2.41
	It's OK for me to complain about teaching activities that are confusing.	2.82	1.51
	It's OK for me to complain about anything that prevents me from learning.	3.62	2.37
Shared control	I help the teacher to plan what I'm going to learn.	3.54	1.31
	I help the teacher to decide how well I am learning.	3.46	1.37
	I help the teacher to decide how much time I spend on learning activities.	3.45	1.36
	I help the teacher to decide which activities I do.	3.54	1.32
	I help the teacher to assess my learning.	3.56	1.33
Student negotiation	I talk with other students about how to solve problems.	3.73	1.28
	I explain my understandings to other students.	3.75	1.30
	I ask other students to explain their thoughts.	3.62	1.40
	Other students explain their ideas to me.	3.52	1.31

Based on Table 1, fifth grade students assessed the learning environment in their science and technology course as higher than moderately constructive. The arithmetic mean of the first four items varies between 4.21 and 3.53. Accordingly, the lowest mean was for the item, "My new learning starts with problems about the world outside of school (X= 3.53; SS= 1.33)" and the highest mean was for the item, "I learn about real life outside of school (X=4.21; SS=1.06)". This research finding suggests that students study real life problems and develop solutions for those problems and that they acquire knowledge related to problems that they may encounter in life, a finding that is consistent with the purpose of the science and technology course.

Upon examining the second sub-factor, scientific uncertainty, it was evident that there were no big differences among the averages. When the four items of the sub-sale were examined,

it was noted that the students agreed more with the statement, "I learn that science may change over time (X= 3.99; SS= 1.61)", and they agreed less with the statement, "I learn about science used by people in other cultures (X= 3.7; SS= 1.21)". According to this finding, it was concluded that students believed that science changes over time, but they did not believe that the changes in science are the result of changes in cultural values. The averages for the items that address the nature of science can be interpreted as the degree to which science is affected by cultural and social values, which, though they are dimensions of the nature of science and though they are part of the science and technology curriculum, they are not discussed. Furthermore, it was concluded that preliminary knowledge of the objectivity of science, which students carried from their previous experiences and which were taught in a dogmatic fashion, is reflected in students' opinions.

The third sub-dimension, critical voice measured the degree to which students' takes responsibility for their own learning in the learning environment. The mean values for this dimension ranged from 2.82 to 3.62. The lowest mean was for the item, "It's OK for me to complain about teaching activities that are confusing (X= 2.82; SS=1.52)", and the highest mean was calculated for the statement, "It's OK for me to complain about anything that prevents me from learning (X=3.62; SS=2.37)". These results that students complained about things that obstructed their learning, but they did not have the right to speak up about the teaching activities used in the classroom.

The mean values for the shared control dimension, which measures the teacher-student interactions, varied between 3.45 and 3.56. The lowest mean was found for the statement, "I help the teacher to decide how much time I spend on learning activities." (X= 3.45; SS=1.36)", and the highest mean was recorded for the statement, "I help my teacher assess my learning" (X= 3.56; SS=1.33)". According to these findings, we concluded that students were informed about assessment and understood that they played a role in helping their teachers assess their knowledge. This is consistent with constructivist learning wherein the student provides information to the teacher about his interests at the assessment stage, which is the final stage of the course, and this helps the teacher to better assess the student's learning. When all items of this dimension were examined, it was found that item values exceeded the average.

When the fifth sub-factor, student agreement, was examined, the highest mean value was obtained for the statement, "I explain my understandings to other students" (X=3.75; SS=1.3)", while the lowest mean value was obtained for the statement, "Other students explain their ideas to me" (X=3.52; SS=1.31)". Accordingly, in the science and technology learning environments, student relationships were determined to be exceeding the average.

The fact that the statement regarding students expressing their opinions had a lower mean compared to other items might be a sign that students are less critical. Particularly, because discussion and group work support the constructivist environment, students' relationships with each other become important.

3.2. Findings Regarding the Second Sub-problem

The second sub-problem was, "Do opinions of fifth grade students about the learning environment in a science and technology course differ with respect to parents' education, facilities of the school, tools in the classroom, opportunities at home, number of books about science and technology at home, frequency of watching television shows about science and technology, opportunities about science education outside the school and frequency of conducting science and technology course outside of school?" To evaluate the impact of these variables, each one was examined separately. A t-test was applied to the data, which included student thoughts about the constructivist learning environment.

An ANOVA test was applied to determine whether parents' level of education affected fifth grade students' opinions about the constructivist learning environment in the science and technology class. The results for the mother's level of education and the father's level of education were analyzed separately using a one-way ANOVA and are presented in Tables 2 and 3, respectively.

Table 2: Results of One Way Analysis of Variance (ANOVA) in Terms of Mother's Level of Education

	Sum of Squares	sd	Squares Average	F	p
Between groups	85.03	70	1.215	1.036	.403
Within groups	732.89	625	1.173		
Total	817.91	695			

The F-value for the mother's level of education was 1.036. The p-value corresponding to this was significant at $p>0.05$. Accordingly, it can be stated that students' opinions regarding a constructivist learning environment did not differ based on the mother's level of education.

Table 3: Differences between Student Opinions According to Father's Education Level

	Squares Total	sd	Squares average	F	P	Significant difference
Between groups	8.89	4	2.22	4.387	.002	Secondary school-High school Secondary school -University
Within groups	350.12	691	.51			
Total	359.01	695				

F-value with respect to the father's level of education was 4.387, and the p-value corresponding to this was significant at $p<0.05$. Accordingly, to this finding, it was determined that students' opinions towards a constructivist environment differed significantly based on the education level of the father. The results of the Tukey test determine the groups in which the differences occurred. According to these results, the mean scores for the constructivist learning environment scale varied in favor of those students whose fathers had graduated from a high school or university. Thus, it was concluded that students whose fathers had a higher level of education exhibited more positive opinions about the constructivist learning environment.

An ANOVA test was applied to test the data regarding the opinions of fifth grade students toward constructivist a learning environment in the science and technology course based on the opportunities the school affords its students the sc. The results of the ANOVA, that is, the differences among students' opinions based on schools opportunities, are presented in Table 4.

Table 4: Differences between Student Opinions According to School Opportunities

	Squares Total	sd	Squares average	F	P	Significant difference
Between groups	7.27	7	1.039	2.032	.049	(Computer lab, science lab, school yard practice field) – (computer lab, science lab, science classroom).
Within groups	351.74	688	.511			
Total	359.01	695				

The F-value for Table 4 with respect to school opportunities was 2.032, and the corresponding p-value was significant at $p<0.05$. Thus, it was determined that students' opinions towards a constructivist environment differ significantly based on the school opportunities offered the students. More specifically, when students' opinions about a constructivist learning environment were compared in terms of opportunities at school, it was found that opinions differed between those students who had access to computer labs, science labs and school yard practice areas and those who had computer labs, science labs and science classrooms. The differentiation between the two favored those students who had computer labs, science labs and science classrooms in the school. Whether there was a school yard practice area did not affect students' opinions about constructivist learning.

An ANOVA test was applied to ascertain the opinions of fifth grade students about a constructivist learning environment in the science and technology course according to the variable instruments provided in the classroom. Differences between students' opinions with respect to the tools available in the classroom are presented in Table 5.

Table 5: Differences between Student Opinions According to the Instruments in the Classroom

	Squares Total	sd	Squares average	F	P	Significant difference
Between groups	4.46	2	2.228	4.355	.013	Written and visual material – visual material
Within groups	354.56	693	.512			
Total	359.01	695				

The F- value for Table 5 with respect to tools available in the classroom was 4.355, and the corresponding p-value was significant a $p<0.05$. Accordingly, it was determined that students' opinions towards a constructivist environment differ significantly based on tools accessible in the classroom setting. The results of the Tukey test further determined the groups in which the differences occurred. The mean scores of the Tukey test indicated that students' opinions regarding the constructivist learning environment differentiated in favor of the those students who had access to both written and visual materials in the classroom. In other words, students who had access to a greater variety of materials evaluated the constructivist approach more favorably than students who did not have such access.

An ANOVA was conducted to determine the relationship between fifth grade students' opinions about a constructivist learning environment in the science and technology course and the opportunities students had in their home environment. Differences between student opinions with respect to home opportunities are presented in Table 6.

Table 6: Differences among Student Opinions With Respect to Opportunities at Home

	Squares Total	sd	Squares average	F	P	Significant difference
Between groups	29.62	6	4.936	10.325	.000	Written and visual material – A room of one's own Written and visual material – Written material Written and visual material – Visual material
Within groups	329.40	689	.478			
Total	359.01	695				

The F-value for Table 6 with respect to opportunities afforded students in the home was 10.325, and the corresponding p-value was significant at $p<0.05$. Thus, with respect to students' opportunities in the home environment, their opinions regarding a constructivist learning environment differ significantly. Students' opinions about constructivist learning environments were compared with respect to home environment, and it was determined that students' opinions varied with respect to those who had only their own room, those who had only written materials, and those who had only visual materials. The variance favored those who had all three. That the materials are various affects students' ideas regarding constructivist learning environments.

An ANOVA test was performed with regards to fifth grade students' opinions about constructivist learning environments and the watching of television shows about science and technology. The results are presented in Table 7.

Table 7: Differences among Student Opinions According to the Frequency that Students Watch Television Shows Related to Science and Technology

Watching TV Shows related with Science and Technology Class	Squares Total	sd	Squares average	F	P	Significant difference
Between groups	13.67	3	4.56	9.134	.000	Everyday – Never Regularly – Never Sometimes – Never
Within groups	345.34	692	.499			
Total	359.01	695				

The F-value for Table 7 with respect to watching televisions shows about science and technology was 9.134, and the corresponding p-value was significant at $p<0.05$. Thus, it was concluded that watching television shows about science and technology significantly affects students' opinions about constructivist learning environments. The results of the Tukey test determine in which groups the differences occurred. The mean scores on the Tukey test favored those students who watch television shows about science and technology every day, regularly or occasionally. Accordingly, it was concluded that students' increased frequency of watching television shows about science and technology positively affected their opinions about constructivist learning environments.

An ANOVA test was performed to determine the relationship between fifth grade students' opinions about constructivist learning environments and the opportunities offered students to learn about science outside the school classroom. The results of the ANOVA are presented in Table 8.

Table 8: Differences among Student Opinions According to Opportunities Offered to Learn About Science Outside of the School

Watching TV Shows related with Science and Technology Course	Squares Total	sd	Squares average	F	P	Significant difference
Between groups	13.67	3	4.56	9.134	.000	Everyday – Never Regularly – Never Sometimes – Never
Within groups	345.34	692	.499			
Total	359.01	695				

The F-value for Table 8 with respect to studying science outside the school classroom was 4.254, and the corresponding p-value was insignificant at $p<0.05$. Thus, it was concluded that students' opinions towards constructivist learning environments differed significantly in terms of the opportunities offered to learn about science outside of the school classroom. The results of the Tukey test determined in which groups the differences occurred. The total score averages differed in favor of those students who had only nature, only museum or only science center field trips. Thus, it was concluded that students' opinions toward constructivist learning environments were positively affected by rich environments that provided students with real life opportunities to learn about science.

An ANOVA was applied to determine the relationship between fifth grade students' opinions about constructivist learning environments and the science and technology course learning environment. The results of the ANOVA are presented in Table 9. The F-value for Table 9 with respect to the classroom environment (conducting the science and technology course outside of the school) was 5.534, and the corresponding p-value was significant at $p<0.05$. Thus, it was concluded that students' opinions towards constructivist learning environments differed significantly with respect to conducting the science and technology class, on occasion, outside of the school.

Table 9: Differences among Student Opinions Based on Conducting Science and Technology Course Outside of the School

Watching TV Shows related with Science and Technology Class	Squares Total	sd	Squares average	F	P	Significant difference
Between groups	13.67	3	4.56	9.134	.000	Everyday – Never Regularly – Never Sometimes – Never
Within groups	345.34	692	.499			
Total	359.01	695				

The results of the Tukey test determined the groups between which groups the differences occurred. The total score averages of the students favored those whose science and technology courses were conducted outside of school onetime per term or three or more times per year. Thus, it was concluded that the opinions of the students toward constructivist learning environments were positively impacted when the science and technology course was conducted, on occasion, outside of the school.

4. DISCUSSION and RESULTS

According to the research findings, students' total scores on the Constructivist Learning Environment Scale were above average, and their scores for all sub-scales were also above average. Thus, according to the opinions of the fifth grade students who participated in this study, a constructivist learning environment was being promoted in the science and technology classrooms. Bal and Doğanay (2010) concluded in their study that a constructivist learning environment in mathematics courses exists at a level considered quite high, and Kesal and Aksu (2005) found that the English language classrooms also, for the most part, implement constructivist learning environments. Fraser et al. (2010) concluded that students in Australia and Indonesia between the ages of 14 and 15 had above average opinions about constructivist learning environments. Thus, the findings of the study indicate that constructivist learning environments were incorporated into the fifth grade science and technology curriculum.

The results of the study revealed that fifth graders learn about real life outside of school in their science and technology course. Özel et al., (2009) found out that the learning processes of fifth, sixth and seventh graders were associated with daily life experiences and that they believed what is learned at school is beneficial in their daily lives. Another finding of the study was that fifth grade students stated that scientists are not affected by the culture around them. This finding suggests that the effect of cultural and social values on the quality of science is not being discussed in the learning environments. Yalvaç, Öztürk and Sarıkaya (2010) found in their study that when elementary school students were asked why scientists reached different results despite having the same knowledge, 40% of the students responded that scientists obtained different results due to reaching the solution from different ways, while 28.8% stated that scientists' education, thoughts and beliefs affected their studies.

While this study concluded that fifth graders expressed their views regarding the activities that were implemented in the science and technology course, their freedom to do so did not reach the desired level. Özel et al. (2009) stated that students experienced difficulty expressing their opinions about situations that might adversely affect their learning. The reason for this difference might be due to the age gap between students in foreign studies and domestic ones as well as the differences in cultures.

This study found that students were given the right to speak during the assessment stage of the science and technology course. In a study by Kaplan (2010), students were found to be effective when being allowed to have a say in the instructional process and when allowed to work with the teacher in the instructional process, a practice that may cause the teacher to question or reflect on his teaching. Saab et al. (2007) stated that there is a significant relationship between planning the activities and the learning environment, while Efe et al. (2007) stated that students complained about the learning environments. In the latter case, some of the students considered the course difficult, while others found it easy. Because in constructivist science education, the priority is on the problems that students are curious about and want to research, the teacher may deviate from previous plans (Bağcı Kılıç, 2007). Therefore, it is important that consideration be given to student capacity, interests and desires and that various teaching methodologies be implemented. For example, teachers should arrange the learning environment such that it incorporates children's developmental needs and it allows for the implementation of various techniques. Such efforts equate to constructivist teaching to the extent that it also encourages the students to participate in the process.

Another result of the study is that fifth graders can communicate with their friends in constructivist learning environments of the science and technology course. In their study, Yurdakul (2008) stated that sixth grade students questioned their own knowledge structures by focusing on others' opinions and considering the various views that were discussed, criticized and assessed, and thus, they become aware of the changing or the constant knowledge structures. Another study on this issue that was conducted by Solomonidou and Kolokotronis (2008), showed that because knowledge is constructed in a social context, generating cooperative learning environments is effective in learning science concepts and facts. The relationships among students are important in constructivist learning environments. Questioning the preliminary information in constructing knowledge is a stage, and thus, in settings where advanced student relations occur, learners are made aware of the conflicts in their own knowledge constructs as social context makes this possible. Students begin to question their knowledge as they listen to the opinions of others. Accordingly, as it is concluded that students gain a multi-dimensional perspective by taking into consideration the opinions and perspectives of others, it is important that teachers ensure setting that promote such exchanges.

This study examined students'' opinions about constructivist learning environments with respect to different variables. The results of the research with respect to these variables are

consistent with other studies. With respect to the mother's level of education, it was concluded that the opinions of fifth graders with respect to the science and technology learning environment did not differ. However, in Anıl's (2009) study, which analyzed PISA results, a linear positive relationship was found between the mother's level of education and the achievement levels of 15-year-old students. In a study by Ersoy (2007) that examined the results of a TIMMS project the mother's level of education positively affected the average success of eight grade students in their courses. However, with respect to the findings in this study, it was concluded that the mother's level of education did not affect students' opinions about learning environments, a finding that may be because some mothers are working mothers while others spend more time with their children.

The study was examined in terms of the father's level of education and determined that the opinions of fifth graders differed in favor of those students whose fathers were high school and university graduates. In Anıl's (2009) study, where PISA results were analyzed, the science achievements of 15–year-old students whose fathers had a high school or university degree exhibited higher levels of science knowledge. In other words, there was a linear positive relationship between the father's level of education and the achievement level of the student. In an OECD report, in many countries, students whose fathers were university graduates were also likely to seek higher education. These findings suggest that the higher the father's level of education the greater the positive effect on the student's attitude towards constructivist learning environments.

It was determined that the elementary school fifth grade students who had a computer lab, a science lab and science courses in their schools had more positive opinions about the learning environments of their science and technology courses than students who only had a computer lab, science lab or a science course. Accordingly, it was concluded that whether there was a school yard practice area at school or not did not affect students' opinions regarding the constructivist learning. Similarly, Özerbaş (2007) concluded that computers in the learning environment had a positive effect on the academic success of eight graders, a finding that shows the importance of a rich constructivist learning environment on the students' construction of knowledge.

In the study, constructivist learning environment score averages as assessed by the students differed in favor of those students who had both visual and written materials in the classroom setting. Therefore, it was concluded students who had access to a large variety of materials in the classroom setting had more positive opinions about constructivist learning environments. Efe et al. (2007) stated that the areas about which students most complained included the following: not enough materials and a classroom setting that did was not appropriate for or did not encourage more advanced studies. One of the opportunities viewed as critical in these settings was the computer. To remain current with today's technological developments and advancements in knowledge, computers are essential. Anıl (2009) puts forth that that students who have their own computers and those who have access to educational-related computer programs and the Internet would increase their science achievements. Karamustafaoğlu (2006) stated that material use in education played an important role in the success of the program and in the success of the students with respect to achieving their goals. This result is consistent with the extant literature.

In the study, it was determined that elementary school fifth grade students who had a room of their own in their home environment and who had access to written and visual materials in the classroom exhibited more positive opinions towards learning environments than those students who only had their own room, or only had access to written materials or to visual materials. Accordingly, it can be said that the variety of materials to which students have access affects their opinions with respect to constructivist learning. A study by Fuch and Woessman (2004) that was based on PISA 2000 data, examined whether there was a relationship between

access to a computer and student success. It was found a positive correlation between computer access at home and student success. Similarly, Ersoy (2007), in a review of the results of the TIMSS project with respect to computer and Internet access at home, found that having such access positively affects the student's success in science courses. These results suggest that students' perceptions, thoughts and achievements depend not only on the school environment but also on the student's environment outside of school.

The study determined that there exists no relationship between the number of books on science and technology in a student's home and students' opinions about constructivist learning environments. However, Ersoy (2007), who examined the results of the TIMMS project, concluded that the number of books in eight grade students' homes positively affected the average success of students with respect to science.

The study also found that elementary school fifth graders who, on a regular basis, watch television shows about science and technology had positive opinions about constructivist learning environments. Such a finding indicates that using the television as part of the learning environment positively affects students' opinions about the learning environment, which may be because students perceive the intense relationship between science and technology as being present in environments where the two are integrated.

In the study, it was found that when fifth graders assess science and technology learning environments in terms of the opportunities offered outside the school, students who were provided nature and museum field trips in addition to the classroom teaching expressed more positive opinions than students who did not have such opportunities. The constructivist learning environment offers students opportunities to implement previous knowledge and skills in a broader scope that includes the world outside the school. Accordingly, it is concluded that learning environments should be rich enough that students can easily associate real life with the knowledge they acquire in the classroom. In a study by Güzel (2008), the subject of limits was taught in the experimental group class, and it was determined that students in the experimental group were more successful in associating the concept of limits with daily life. Because one of the general purposes of the science and technology curriculum is to ensure that students learn and understand the natural world and experience its cognitive richness and excitement (MEB, 2005), the quality of the learning environment has gained importance as it plays an important role in developing science and technology literate individuals.

In light of the findings of this research, the following recommendations are made:

Associating constructivist learning environments with life has an important place in students' perceptions. Therefore, it should be ensured that students spend time in such environments and that relevant field trips be organized.

The richness of the constructivist learning environment has a significant place in students' perceptions. Therefore, schools should seek to improve their equipment as well as their physical space, and teachers should encourage and promote the use of updated, state-of-the-art equipment.

In this study, the focus was on the constructivist learning environment in science and technology courses. Given that students may have different thoughts and attitudes about different courses, their thoughts about constructivist learning environments can be examined either independently or in relation with their science and technology courses.

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Genişletilmiş Özet

Bu çalışmada, ilköğretim beşinci sınıfta öğrenim gören öğrencilerin fen ve teknoloji dersindeki öğrenme ortamlarını yapılandırmacılık açısından değerlendirmelerinin çeşitli değişkenler açısından incelenmesi amaçlanmıştır. Çalışma, tarama modeline dayalı olarak desenlenmiştir. Araştırma verileri, Bilecik ili Bozüyük ilçesinde Milli Eğitim Bakanlığına bağlı 20 resmi ve bir özel ilköğretim okulunda okuyan beşinci sınıf öğrencilerinden toplanmıştır. 696 öğrenci uygulama kapsamına alınmıştır.

Araştırmada veri toplama aracı olarak iki bölümden oluşan anket kullanılmıştır. Anketin birinci bölümünde öğrencilere ilişkin kişisel bilgiler, öğrenme ortamının özelliklerini ve öğrencilerin sahip olduğu olanakları sorgulayan maddelere yer verilmiştir. İkinci bölümde ise, öğrencilerin Fen ve Teknoloji dersindeki öğrenme ortamlarını değerlendirdikleri "Yapılandırmacı öğrenme ortamı" ölçeği kullanılmıştır. İstatistiksel veri analizinde aritmetik ortalama, standart sapma, yüzde hesaplamaları, t-testi ve ANOVA kullanılmıştır.

Araştırma sonuçlarına göre; ilköğretim beşinci sınıf öğrencilerinin Fen ve Teknoloji dersindeki öğrenme ortamlarını orta düzeyin üzerinde yapılandırmacı olarak değerlendirdiği ortaya çıkmıştır.

Anne eğitim durumu açısından öğrencilerin yapılandırmacı ortama yönelik görüşlerinin farklılaşmadığı fakat baba eğitim durumuna göre öğrencilerin yapılandırmacı ortama yönelik görüşlerinin anlamlı derecede farklılaştığı söylenebilir. Baba eğitim düzeyleri ile öğrencilerin Fen ve Teknoloji derslerindeki öğrenme ortamlarına yönelik görüşleri arasında pozitif yönde farklılık olduğu görülmüştür. Öğrencilerin yapılandırmacı öğrenme ortamı ölçeğinden aldıkları puan ortalamalarının, babası lise ve üniversite bitirmiş olan öğrenciler lehine farklılaştığı görülmektedir. Buna göre baba eğitim durumu daha yüksek olan öğrencilerin, yapılandırmacı öğrenme ortamı hakkındaki görüşlerinin daha olumlu olduğu söylenebilir

Öğrencilerin öğrenme ortamlarının gerçek yaşama dönük olması ile ev ve okul ortamlarının zengin olmasının öğrenme ortamlarına yönelik görüşlerini olumlu düzeyde değiştirdiği belirlenmiştir. Okulun sahip olduğu olanaklara göre öğrencilerin yapılandırmacı ortama yönelik görüşlerinin anlamlı derecede farklılaştığı söylenebilir. Bu farklılaşma okulunda bilgisayar laboratuarı, fen laboratuarı ve fen derslikleri bir arada bulunanlar lehine olduğu görülmektedir.

Sınıf ortamında bulunan olanaklara göre öğrencilerin yapılandırmacı ortama yönelik görüşlerinin anlamlı derecede farklılaştığı söylenebilir. Sınıf ortamında bulunan materyallerin çeşitliliği çok olanların, yapılandırmacı öğrenme ortamı hakkındaki görüşlerinin daha olumlu olduğu görülmektedir.

İlköğretim beşinci sınıf öğrencilerinin, evde sahip olunan olanaklar değişkeni açısından Fen ve Teknoloji dersindeki yapılandırmacı öğrenme ortamına ilişkin düşüncelerini içeren verileri test etmek üzere ANOVA uygulanmıştır. Öğrencilerin ev ortamında sahip olduğu olanaklar açısından, ev ortamında bulunan olanaklara göre öğrencilerin yapılandırmacı öğrenme ortamı hakkındaki görüşlerinin anlamlı derecede farklılaştığı sonucuna ulaşılmıştır.

Okul dışında fen öğrenmelerine yönelik sunulan olanaklar açsından, yapılandırmacı öğrenme ortamına yönelik düşüncelerinin anlamlı derecede farklılaştığı görülmektedir. Ev ortamı açısından

öğrencilerin yapılandırmacı öğrenme ortamı hakkındaki görüşlerini karşılaştırıldığında sadece kendi odası, yazılı materyalleri ve görsel materyalleri olanlar ile evde kendi odası ile birlikte yazılı, görsel materyalleri bulunan öğrencilerin görüşleri arasında farklılaştığı görülmektedir. Bu farklılaşma kendine ait odası, yazılı ve görsel materyalleri bir arada bulunan lehine olduğu görülmektedir. Buna göre, öğrencilerin ev ortamında etkileşimde bulunacakları materyallerin çeşitli olması, onların yapılandırmacı öğrenme hakkındaki görüşlerinin daha olumlu düzeyde etkilediği söylenebilir.

İlköğretim beşinci sınıf öğrencilerinin fen ve teknoloji dersi ile ilgili televizyon programları izleme sıklıkları açısından, öğrenme ortamlarına ilişkin düşüncelerinin anlamlı derecede farklılaştığı görülmektedir. Bu sonuç bize öğretim ortamında bulunan televizyon etkeninin öğrencilerin bu ortama yönelik düşüncelerini değiştirdiğini gösterir.

İlköğretim beşinci sınıf öğrencilerinin, okul dışında fen öğrenmelerine yönelik sunulan olanaklar değişkeni açısından Fen ve Teknoloji dersi yapılandırmacı öğrenme ortamına yönelik görüşlerini içeren verilere ANOVA uygulanmıştır. Okul dışında fen öğrenmelerine yönelik sunulan olanaklar açsından anlamlı bir farklılık gözlenmektedir. Bu bulguya göre, okul dışında fen öğrenmelerine yönelik sunulan olanaklar açsından, yapılandırmacı öğrenme ortamına yönelik düşüncelerinin anlamlı derecede farklılaştığı söylenebilir. Farkın hangi gruplar arasında olduğunu belirlemek için yapılan Tukey testi sonuçlarına göre öğrencilerin yapılandırmacı öğrenme ortamı ölçeğinden aldıkları toplam puan ortalamalarının, doğa ve müze gezilerini bir arada gerçekleştiren öğrencilerin, sadece müze, sadece doğa ve sadece bilim merkezi gezilerini gerçekleştiren öğrenciler lehinde farklılaştığı görülmektedir. Buna göre öğrenciler okul dışında fen öğrenmelerine yönelik sunulan olanaklar açısından gerçek yaşam ile ilişkili zengin ortamlarda bulunan öğrencilerin yapılandırmacı öğrenme ortamı hakkındaki görüşleri daha olumlu olduğu söylenebilir.

İlköğretim beşinci sınıf öğrencilerinin, fen ve teknoloji dersini okul dışında gerçekleştirme durumu bakımından öğrencilerin yapılandırmacı öğrenme ortamı hakkındaki görüşlerinin anlamlı derecede farklılaştığı söylenebilir. Fen ve teknoloji dersini okul dışında dönemde bir kez ve yılda üç kez ve daha fazla gerçekleştirenlerin lehinde farklılaştığı görülmektedir. Araştırmada ilköğretim beşinci sınıf öğrencilerinin okul dışında sunulan olanaklar açısından fen ve teknoloji öğretim ortamlarını değerlendirdiklerinde doğa ve müze gezilerini bir arada gerçekleştiren öğrencilerin daha olumlu görüşlere sahip olduğu sonucuna ulaşılmıştır.

Buna göre fen ve teknoloji dersini okul dışında gerçekleştirme sıklığı fazla olan öğrencilerin, yapılandırmacı öğrenme ortamı hakkındaki görüşlerinin daha olumlu olduğu görülmektedir

Araştırmanın en genel sonucu ilköğretim beşinci sınıf öğrencilerinin fen ve teknoloji dersindeki öğrenme ortamlarının yapılandırmacı ilkelere uygun olarak bulmalarıdır. Bunun yanı sıra ulaşılan sonuçlar şöyle ifade edilebilir.

Öğrencilerin öğrendiklerini yaşam ile ilişkilendirdikleri

Bilimin doğasına yönelik bilgilerinin yeterli olmadığı

Etkinliklerde kendilerinin ifade edebildikleri ama bunun yeterli düzeyde olmadığı

Değerlendirme etkinliklerinde söz sahibi oldukları

Öğrenci-öğrenci etkileşiminin yeterli olduğudur

Bunun yanı sıra öğrencilerin yapılandırmacı öğrenme ortamına yönelik görüşlerinin;

Baba eğitim durumuna

Okulun olanaklarına

Kullanılan materyalin çeşitliliğine

Ailenin sunduğu olanaklara

Okul dışı öğrenme ortamlarında fen öğrenmelerine göre değişiklik gösterdiği sonuçlarına ulaşılmıştır.

Yapılandırmacı öğrenme ortamı daha önceki bilgi ve beceri, okulun dışındaki dünya da dâhil, geniş bir alanda uygulamak için birçok fırsatlar sunar. Bu nedenle öğrenme ortamları öğrencilerin gerçek yaşam ile kendi bilgilerinin kolaylıkla ilişkilendirebilecek zenginlikte olmalıdır. Öğrencilerin fen ve teknoloji

okur-yazar bireyler olarak yetiştirilmesinde bu tür öğrenme ortamlarının niteliği önem kazanmaktadır. Çünkü fen ve teknoloji öğretim programının genel amaçlarından birisi, öğrencilerin doğal dünyayı öğrenmeleri ve anlamaları, bunun düşünsel zenginliği ile heyecanını yaşamalarını sağlamaktır.

Citation Information

Nayman, Ö., Berber, A., Anagün, Ş. S. & Yıldız, Z. (2015). Assessing the Learning Environment in Science and Technology Course Based on Constructivism. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi [Hacettepe University Journal of Education], 30*(1), 178-194.