

Investigating 8th Grade Students' Perceptions of Constructivist Science Learning Environment*

Sekizinci Sınıf Öğrencilerinin Yapılandırıcı Fen Öğrenme Ortamı Hakkındaki Algılarının İncelenmesi

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Abstract

The present study investigated 8th grade students' perceptions of actual and preferred constructivist science learning environments. Data were collected from 1152 students attending public elementary schools in Ankara using the Constructivist Learning Environment Survey (CLES). The CLES consists of two forms which are "Actual" and "Preferred". While actual form assesses the current learning environment of the classroom and the preferred form assesses the students' preferences about the learning environment. Results showed that students' scores on the preferred form were significantly higher than those of the actual form on each scale ($p<0.05$). Students tended to prefer more constructivist learning environments in which they have more opportunities to relate science with the real world, communicate in the classroom, take role in the decision making process of what will go on in the lesson to be more beneficial for them, question what is going on in the lesson freely and experience the formulation of scientific knowledge.

Key words: Learning Environment, Constructivism, Students' Perceptions

Öz

Bu çalışmada, sekizinci sınıf öğrencilerinin mevcut ve tercih ettikleri yapılandırıcı fen öğrenme ortamı hakkındaki algıları incelenmiştir. Veriler, 1152 sekizinci sınıf öğrencisinden Yapılandırıcı Öğrenme Ortamı Ölçeđi kullanılarak toplanmıştır. Bu ölçek, "mevcut" ve "tercih edilen" öğrenme ortamını değerlendiren iki bölümden oluşmaktadır. Ölçeđin mevcut öğrenme ortamı bölümü, sınıflardaki şu anki fen bilgisi öğrenme ortamının yapılandırıcı öğrenme yaklaşımını ne kadar yansıttığını ölçerken, tercih edilen öğrenme ortamı bölümü ise öğrencilerin tercih ettikleri öğrenme ortamını ölçmektedir. Sonuçlar, ölçeđin her alt boyutu için tercih edilen yapılandırıcı öğrenme ortamı algılarının mevcut öğrenme ortamı algılarına göre daha yüksek değerlerde olduğunu göstermiştir ($p<0.05$). Öğrenciler, bilimin deđişebilen yapısını ve günlük hayatla ilişkisini öğrenmede fırsatlar sunan, birbirleriyle tartışma imkânı sağlayan, sınıf içi etkinliklerin planlamasında karar verme mekanizmasında rol oynayan ve gerektiğinde kritik edebilen öğrenme ortamlarını tercih etmektedirler.

Anahtar Sözcükler: Öğrenme ortamı, Yapılandırıcı Öğrenme Yaklaşımı, öğrenci algıları.

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Introduction

The classroom has become an important place for educational research because most learning takes place there. The socio-psychological environment or classroom learning environment has been extensively researched in the past three decades. Research studies have provided consistent and convincing evidence that the quality of the classroom environment is a significant determinant of student learning (Fraser, 1994, 1998). It has been established that a positive learning environment is influential in student achievement and attitudes (Fisher, Henderson & Fraser, 1995).

Previous research has indicated that students' perceptions of learning environment are an important factor in explaining their cognitive and affective outcomes (Fraser, 1994, 1998). In his review of past studies, Fraser (1998) stated that associations between outcome measures and classroom environment perceptions have been replicated for a variety of cognitive and affective outcomes, with a variety of instruments, across numerous countries and grade levels. Learning environment research has studied these associations in different types of classroom environments (Fraser, 2002), such as science laboratory classroom environments, computer-assisted instruction classrooms, constructivist classroom environments, cross-national studies of science classroom environments and computer laboratory classroom environments. Previous research also notes that there are gender, subject, grade-level, school type, school location (city and rural) and ethnic-related differences in classroom learning environments (Fraser, 1998; Waldrup & Fisher, 2000; Waxman & Huang, 1998).

Research studies have shown that student outcomes can be enhanced by changing classroom environment in ways, which make it more congruent with that preferred by the students (Fraser & Tobin, 1998). This process of changing classroom environments involves assessing students' perceptions of their actual and preferred classroom environments, identifying discrepancies and then implementing strategies to reduce these differences. Past studies have indicated that, even when actual classroom environment is considered favorable to learning; students still prefer a more positive learning environment. In addition, research showed that teachers and students possess different perceptions of the classroom environment and teachers generally perceive the learning environment favorably than students (Fraser & Tobin, 1989).

Although learning environment research originated in Western countries, Asian researchers in the last decade have made many major and distinctive contributions to the field of learning environments. For example, researchers working in Indonesia (Margianti, Fraser & Aldridge, 2001), Singapore (Fraser & Chionch, 2000), Korea (Kim, Fisher & Fraser, 1999, Lee & Fraser, 2001) and Brunei (Scott & Fisher, 2001) conducted similar studies, reporting strong associations between the learning environment and student outcome for almost all scales. Despite the fact that a great deal of learning environment research has been conducted all over around the world, Turkey, with few related work (Telli, Cakiroglu, & den Brok, 2006, Arisoy, Cakiroglu & Sungur, 2007; Cakiroglu, Tekkaya & Rakici, 2007), is a relatively new participant in the learning environment domain.

There is a wide variety of economical and valid questionnaires that have been used to assess students' perceptions of the learning environment including Constructivist Learning Environment Survey (CLES) (Taylor & Fraser, 1991). The CLES was developed to assist educators and researchers to measure students' perceptions of the extent to which constructivist approaches are present in classrooms. It has been used in a variety of studies, including a study of science education reform efforts in Korea (Kim, Fisher & Fraser, 1999), a comparison of

classroom environments in Taiwan and Australia (Aldridge, Fraser, Taylor & Chen, 2000), a study of the relationship between classroom environment and student academic efficacy in Australia and England (Dorman & Adams, 2004), a cross national validation of the CLES in mathematics classes in Australia, Canada and the United Kingdom (Dorman, Adams, & Ferguson, 2001), an investigation of the relationships between students' scientific epistemological beliefs and their perceptions of constructivist learning environments (Tsai, 2000), a case study of a tertiary computer classroom in Thailand (Wanpen & Fisher, 2006). For example, in Korea, Kim, Fisher and Fraser (1999) investigated the extent to which a new general science curriculum, reflecting a constructivist view, has influenced the classroom learning environment in grade 10 science. A sample of 1083 tenth and eleventh grade students and 24 science teachers in 12 different schools completed the actual and preferred versions of the CLES and a seven-item attitude scale. Results showed that grade 10 students did perceive a more constructivist learning environment than grade 11 students who had not been exposed to the new curriculum. Students tended to prefer a more positive environment than what was perceived to be present and statistically significant relationships were found between classroom environment and student attitudes. The results suggest that favorable student attitudes could be promoted in classes where students perceive more personal relevance, shared control with their teachers and negotiate their learning.

Recently, Arisoy, Cakiroglu, and Sungur (2007) examined the relationship between students' perceptions of the science classroom environment from constructivist perspective and their adaptive motivational beliefs. A sample of 956 eight grade students in 36 elementary science classes in Turkey completed Turkish versions of the CLES, and Motivated Strategies for Learning Questionnaire (MSLQ). Results of a canonical analysis showed that perception of higher levels of five key elements of critical constructivist learning environment—personal relevance, uncertainty, critical voice, shared control, and social negotiation—were associated with higher levels of students' adaptive motivational beliefs. This finding suggests that favorable student motivation could be increased in classes where students perceive more personal relevance, shared control with their teachers, freedom to express concern about their learning, science as ever changing, and interact with each other to improve comprehension.

Purpose

This study was performed to investigate 8th grade students' perceptions of actual and preferred constructivist science learning environments. The specific question of the study was: Is there a statistically significant difference between students' perceptions of actual and preferred constructivist science learning environments?

Method

Sample

A total of 1152 eight grade students attending public elementary schools in a large district of Ankara involved in the study. Of 1152 students, 46.1 % were girls and 53.9 % were boys with a mean age of 14.1.

Data Collection Tool

Constructivist Learning Environment Survey (CLES) was used to assess the students' perceptions of the extent that the learning environment in a classroom is constructivist oriented. The survey was based on the one revised by Johnson and McClure (2004) which was originally developed from Taylor and Fraser's (1991). The

CLES contained 20 items, with 5 scales (4 items in each scale). The scales are Personal Relevance, Student Negotiation, Shared Control, Critical Voice and Uncertainty. It is a five point response scale of "Almost Always, Often, Sometimes, Seldom, Almost Never". Moreover, the survey consists of two forms that are "Actual" and "Preferred" Forms. Actual form assesses the present learning environment of the classroom and the preferred form assesses the students' preferences about the learning environment. Even though item wording is almost identical in both forms, words such as 'I prefer' are used in the preferred form. For example, the statement, "In this science class, I ask other students to explain their ideas" in the actual form of the CLES is changed in the preferred form to, "In this science class, I prefer to ask other students to explain their ideas". Each scale, its description and a sample item regarding each subscale is presented in Table 1.

CLES was translated and adapted into Turkish by Yılmaz-Tüzün, Çakıroğlu and Boone (2006). The present study yielded the α -reliability to be .57 (Uncertainty), .69 (Critical Voice), .69 (Student Negotiation), .72 for (Personal Relevance) and .74 (Shared Control) for actual form and .69, .76, .74, .78 and .77 for preferred form respectively, indicating moderate to high reliability.

The first author collected the data in two weeks in the spring semester of 2005-2006. It took 20-minutes for the students to complete the both forms (actual and preferred) of the CLES. All the necessary explanations were done and the directions were made clear by the researcher before the students completed the CLES.

Table 1.
Scales, Scale Descriptions and Sample Items for the CLES

Scales	Scale description	Item Sample (Actual Form)	Item Sample (Preferred Form)
Personal Relevance	Extent to which teachers relate science to students out of school experiences.	In this science class, I learn about the world inside and outside of school.	In this science class, I prefer to learn about the world inside and outside of school.
Student Negotiation	Extent to which opportunities exist for students to explain and justify to other students their newly developing ideas.	In this science class, I ask other students to explain their ideas.	In this science class, I prefer to ask other students to explain their ideas.
Shared Control	Extent to which students are invited to share with the teacher control of the learning environment.	In this science class, I help the teacher to plan what I am going to learn.	In this science class, I prefer to help the teacher to plan what I am going to learn.
Critical Voice	Extent to which a social climate has been established in which students feel that it is beneficial to question the teacher's pedagogical plans and methods to express concerns about any impediments to their learning.	In this science class, I feel safe questioning what or how I am being taught.	In this science class, I prefer safe questioning what or how I am being taught.
Uncertainty	Extent to which opportunities are provided for students to experience scientific knowledge as arising from theory dependent inquiry.	In this science class I learn the views of science have changed over time.	In this science class I prefer to learn the views of science have changed over time.

All scale descriptions are taken from Taylor et al. (1997).

Results

One of the characteristics of a learning environment scale is that students within a class see their learning environment in a relatively similar manner, and that average class perceptions vary from class to class. In the learning environment research, statistical analysis often are performed for two levels or unit of analysis, namely, the individual student's scores and the class mean score (McRobbie & Fraser, 1993). For that reason, in the present study results were reported by using both the individual student and the class mean as the units of statistical analysis.

Descriptive statistics for each of the scales of the actual and preferred forms of CLES are given on Table 2. As shown in the table, while students perceive their actual learning environments as moderately constructivist, they prefer more constructivist learning environments where they have more opportunities to relate science with the real world, communicate in the classroom, take role in the decision making process of what will go on in the lesson to be more beneficial for them, question what is going on in the lesson freely and experience the formulation of scientific knowledge.

Table 2.

Perceptions of Constructivist Learning Environments as assessed by CLES Actual and Preferred forms by Individual and Class Mean Unit of Analysis (N= 1152 for the individual analyses and N= 40 for the class mean analyses)

CLES Scales	Unit of Analysis	Actual (A)		Preferred (P)		Mean Difference (P-A)	t value
		M	SD	M	SD		
Student Negotiation	Individual	12.03	3.68	14.91	3.92	2.88	-24.63*
	Class	12.15	1.20	14.93	1.25	2.78	-14.622**
Shared Control	Individual	9.90	4.00	14.40	4.20	4.5	-31.64*
	Class	10.05	1.33	14.52	1.11	4.47	-20.817**
Uncertainty	Individual	12.02	3.38	14.63	3.77	2.61	-20.58*
	Class	12.10	1.26	14.64	1.10	2.54	-10.760**
Personal Relevance	Individual	13.42	3.87	15.98	3.81	2.56	-20.78*
	Class	13.52	1.73	16.02	1.42	2.5	-10.218**
Critical Voice	Individual	13.01	3.84	16.09	3.69	3.08	-24.25*
	Class	13.13	1.44	16.09	1.11	2.69	-12.893**

* $p < 0.05$, ** $p < 0.01$

As far as the individual unit of analysis is concerned, Table 2 indicated that students perceive their actual learning environments mostly as offering adequate opportunities for them to relate science to real world ($M = 13.42$), and question what is going on in the lesson freely ($M = 13.01$), experience the formulation of scientific knowledge ($M = 12.02$) and communicate in the classroom ($M = 12.03$). However, most of the students do not find adequate opportunities to take role in the decision making process of what will go on in the lesson to be more beneficial for them ($M = 9.90$). Students prefer learning environments, however, that mostly offer them chance to question what is going on in the lesson freely ($M = 16.09$). The students also prefer to have learning environments that offer them to relate science with real world ($M = 15.98$), communicate in the classroom ($M = 14.91$), have chance to experience the formulation of scientific knowledge ($M = 14.63$) and take role in the decision making process of what will go on in the lesson to be more beneficial for them ($M = 14.40$).

To investigate the differences between students' perception of the actual and preferred learning environment, paired t-tests was carried out (Table 2). Paired t-tests results showed that students' scores on the preferred form were significantly higher than those of the actual form on each scale. A clear picture can be shown in Figure 1. This means that the actual learning environment did not adapt students' preferences. In other words, the students prefer more constructivist learning environments where they have more opportunity to relate science with the real world, communicate in the classroom, take role in the decision making process of what will go on in the lesson to be more beneficial for them, question what is going on in the lesson freely and experience the formulation of scientific knowledge.

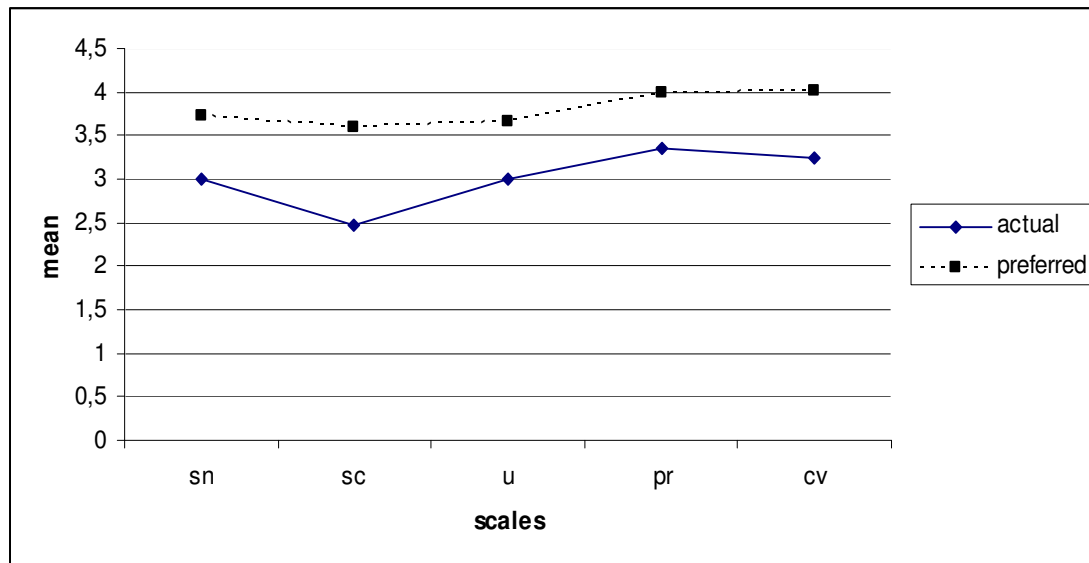


Figure 1. Scale Means for Actual and Preferred Forms of the CLES using Individual Mean as the Unit Analysis. Note: sn = student negotiation, sc= shared control, u= uncertainty, pr= personal relevance, cv= critical voice

As far as class means are concerned, it is seen that, classes had significantly higher scores on the CLES preferred from than those on the actual form (Table 2). When using paired t-tests to examine the difference between classes' perceptions of the actual learning environments and the preferred learning environments, it was found that classes' scores on the preferred form were significantly higher than those of the actual form on each scale. This means that the actual learning environment did not adapt their preferences in other words the classes prefer more constructivist learning environments where they have more opportunity to relate science with the real world, communicate in the classroom, take role in the decision making process of what will go on in the lesson to be more beneficial for them, question what is going on in the lesson freely and experience the formulation of scientific knowledge. A clear picture can be seen in Figure 2.

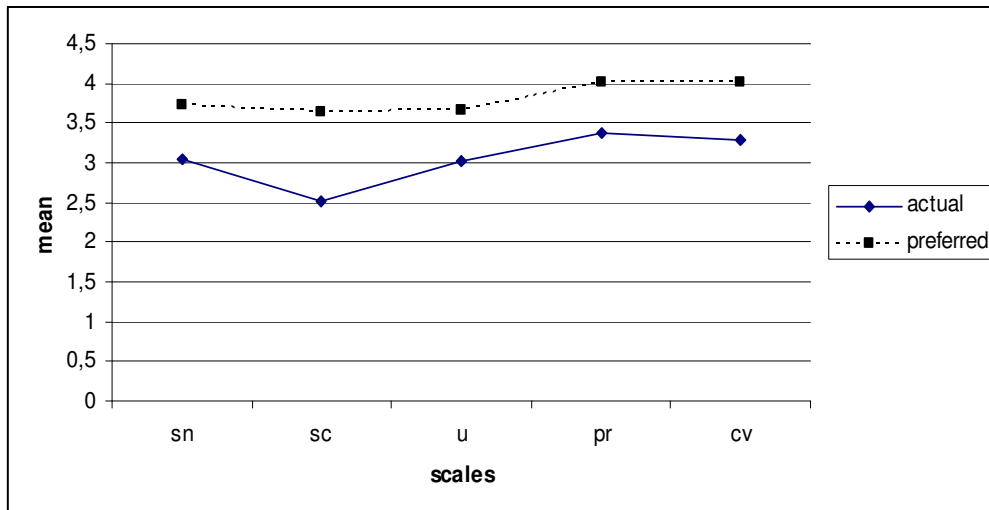


Figure 2. Scale means for Actual and Preferred Forms of the CLES using Class Mean as the Unit Analysis. Note: sn = student negotiation, sc= shared control, u= uncertainty, pr= personal relevance, cv= critical voice

Discussion and Conclusion

In the study, 8th grade students' perceptions of actual and preferred constructivist science learning environments were investigated. Concerning students' responses to actual form of CLES, the highest mean score was obtained for Personal Relevance indicating that the learning environment in science classroom emphasizes relevance to everyday life. As far as nature of science curriculum is considered, this result is not surprising. In order to promote meaningful learning in science it is necessary to connect science content with students' daily life experiences. It is also possible that getting a high score from high stake examinations, teacher might stress the science content personally relevant to the students' everyday experience. Results also indicated that students generally had a less positive view of the shared control with the lowest mean score. This implied that students perceived that their teachers are not sharing aspects of learning science with their students. In other words, all learning activities are planned and managed by the teachers. Students perceived that science teacher, as an expert is more able to make decisions regarding teaching, planning and assessing than the students.

Regarding their responses to preferred form of the CLES, the highest mean score was observed for the Critical Voice, indicating that students prefer to express their thoughts and criticisms about learning and how it might be improved. Finding such a high score is interesting, considering the fact that traditionally in Turkish culture students are expected to have a high degree of respect for their teachers and not criticize their teachers about the way in which they are taught. It is necessary to note that the mean score of Critical Voice in actual form was also high. They are willing to question the teacher's pedagogical plans and methods to express concerns about any impediments to their learning.

In general, participants' scores on preferred form were much higher than those on actual form. As shown by t-test results, there were statistically significant differences between student perceptions of actual and preferred science learning environments. For example, they perceived that their actual science learning environments did not provide enough opportunities for Student Negotiations, Shared Control, Critical Voice, and Uncertainty (see Table 2). These findings suggested that majority of participants believed that their actual learning

environments did not match their preferences well and they had a tendency to prefer learning environments in which they could have more opportunities to relate science with the real world, communicate in the classroom, take role in the decision making process of what will go on in the lesson to be more beneficial for them, question what is going on in the lesson freely and experience the formulation of scientific knowledge.

The findings of the present study were similar with those reported in the literature (e.g. Fraser & Tobin, 1998; Kim, Fisher & Fraser, 1999; Tsai, 2000). For example, Tsai (2000) found that there were statistically significant differences between student perceptions of actual and preferred learning environments. He also reported that Taiwanese 10th-grade students perceived their actual learning environment as less constructivist that what they preferred. Similarly, Kim et al. (1999) found that 10th and 11th grade Korean students preferred a more positive learning environment than the one actually practiced.

As the notion of constructivism is one of the main thrusts of the new Science and Technology curriculum in Turkey, current study demonstrated that 8th grade students have a tendency to perceive that their actual science learning environments were less constructivist compared to what they preferred. These findings suggested that science teachers should conduct their instructions more oriented to constructivist approach for students than currently implemented. It is hoped that this study provides an initial insight about constructivist learning environments in Turkish science classrooms and helps the teachers to improve their practice in conducting science teaching and assists classroom teachers to enhance their classroom environment. Studying comparison of students' perceptions of their actual environment with their preferred environment gives teachers the opportunity to modify the classroom environment to match more closely actual and preferred environments. Research suggested that changing the actual classroom environment in ways that make it more congruent with that preferred by the students is likely to enhance student outcomes.

This study has some limitations to consider in any attempt to generalize the findings. The study is limited because of its reliance on self-reported data. Following research is needed to verify the consistency of the present findings by use of multiple methods and measures. Observations and interviews with both teachers and students, however, needed to check whether these findings mirror the real situation. Second, we conducted this investigation at public schools located in a large urban area. Data from other school districts and from other school types might provide different results. Similarly, this study was limited to 1152 eight grade students. The results may not be reliable if generalized beyond students enrolled in a similar situation. For further research, relationship between students' perceptions of learning environments and other variables, such as science achievement, attitude towards science should be examined

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