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Title

Turkish secondary education students' perceptions of their classroom learning environment and their attitude towards Biology

Authors

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Authors' bio information

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Abstract

The domain of learning environments research has produced many promising findings, leading to an enhancement of the teaching and learning process in many countries. However, there have been a limited number of studies in this field in Turkey. For that reason, the purpose of the present study was to examine Turkish high school students' perceptions of their classroom environment in biology and to investigate relationships between these perceptions and students' attitudes toward biology. Secondly, the study aimed to investigate differences in students' attitudes toward biology by gender, grade level, and parental education. Perception data were gathered with 1983 ninth and tenth grade students from 57 biology classes at schools in two major Turkish cities. Data were collected with an adapted and translated version of the "What is Happening in This Classroom" (WIHIC) instrument and the "Test of Science Related Attitudes" (TOSRA). Correlation and regression analyses revealed that students' perceptions of their learning environment in biology were significantly associated with their attitudes. In addition, results of the study revealed that there were significant differences gender and grade level. The study discusses these findings and compares them to prior learning environment studies.

Key words: classroom environment, Turkey, secondary education, student perceptions, attitudes toward biology, teacher effectiveness

1. Introduction

According to Fraser (2000), students have spent approximately 20.000 hours in classrooms by the time they finish their university education. This time devoted to schooling is focused mainly on the academic achievement of students. Teachers, students and schools face a variety of problems when realizing a productive learning environment for all these hours, such as lack of choice and opportunity in educational programs, lack of funding, dissatisfied and burnt-out teachers, problems in teacher quality, low grades, et cetera. Another problem, often mentioned by both experienced and beginning teachers, is low attitudes of students toward school and school subjects (e.g. Veenman, 1984). Because student attitudes are such a point of concern, in particular in the science subjects, because they are the focus of many governments due to shortage of teachers and students in these subjects, and due to the fact that there is a strong relationship between students' attitudes and their academic and cognitive achievement (e.g. Creemers, 1994), the present study focuses on student attitudes and the way these are affected by the classroom environment.

Fraser (1986) argues that perceptions of the students and the teachers are crucial if one is to investigate the learning environment (see also Wubbels, & Brekelmans, 1998). The role of teachers' and students' perceptions of the classroom environment in influencing cognitive and affective outcomes has been addressed in many learning environment studies and a strong link between student outcomes and their perceptions of learning environment's have been shown by many researchers (Fraser & Fisher, 1982; Wubbels, & Brekelmans, 1998; den Brok, Brekelmans, & Wubbels, 2004). 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.

Researchers studying classroom environments have used various instruments for collecting data over the years (Fraser, 1998)[1]. Based on these instruments and the links showed with student outcomes, Fraser, Fisher, and McRobbie (1996) developed a learning environment instrument called the *What Is Happening In This Class?* (WIHIC) questionnaire. This questionnaire has been used by many researchers from different countries to collect data about the classroom environment. It has been validated in Australia (Rawnsley, & Fisher, 1998) and Taiwan (Aldridge, Fraser, & Huang, 1999), Singapore (Chionh & Fraser, 1998), Korea (Kim, Fisher, & Fraser, 2000), Indonesia (Margianti, Fraser, & Aldridge, 2002) and United States (see den Brok, Fisher, Rickards, & Bull, in press, for an overview) and validated cross-nationally (Dorman, 2003). Because of its cross-cultural validity, the WIHIC was selected as one of the questionnaires for this study in Turkey.

[1] Early instruments used in the educational learning environment include the Learning Environment Inventory (LEI), The My Class Inventory (MCI) and Questionnaire on Teacher Interaction (QTI), Individualized Classroom Environment Questionnaire (ICEQ), College and University Classroom Environment Inventory (CUCEI), the My Class Inventory (MCI), Questionnaire on Interaction (QTI), Science Laboratory Inventory (SLEI), and Constructivist Learning Environment Survey (CLES).

Strong associations between students' perceptions and students' outcomes have been reported for almost all scales of the WIHIC (Chionh, & Fisher, 1998; Hunus, & Fraser, 1997; Rawnsley, & Fisher, 1998; Wahyudi, 2004). Although most classroom environment research involved students in Western countries, a number of important studies have been carried out in non-Western countries (Fraser, 1998; 2002). While a growing body of research develops on the subject of learning environment in Western and non-Western countries, such research is scarce in Turkey. The domain of learning environments research is a new born research field in Turkey, although few related works are available (Rakıcı, 2004; Şimşeker, 2005). This study is the first in its kind to connect the WIHIC to student attitudes in Turkey and thereby adds significantly to this field in the region. Moreover, the study adds to the existing knowledge base on WIHIC-related studies by investigating effects on student attitudes conjointly with other possible relevant background variables, something that has not been attempted before. The outcomes of this study might be a base for improvement and evaluation of teaching and classrooms in Turkey. Finally, this study may add to the cross-national validity of the learning environment instruments used, thereby providing more insight in the cultural variation that may exist in learning environments across the world, an area of current and future interest to the learning environments domain (e.g. Fraser, 2002).

In this contribution, we will discuss some of the previous research (in other countries) that has investigated the link between student attitudes and the learning environment. Before doing so, we will shortly elaborate on the topic of students' subject-related attitudes. We will also elaborate on the context of our study, the Turkish educational system. After a presentation of the research question(s) and methodology of our study, we will provide the results and compare these with prior research. Ultimately, we will present some implications, in particular with respect to possible future research.

2. Education in Turkey: the context of the study

This section introduces a brief overview of Turkey, its geographical location, as well as background information about the Turkish educational system.

Turkey, officially named as The Republic of Turkey, is located on the two continents of Europe and Asia and had a population of 67.8 million in 2000. The Ministry of National Education is responsible for all educational services in the country excluding higher education. Furthermore, the government provides scholarships and other means to support the education of successful students coming from materially deprived families.

The Turkish education system consists of two main divisions: formal and non-formal education. Formal Education is divided into four levels: (1) pre-school education, (2) primary education, (3) secondary education, and (4) higher education. Pre-school education is the broad term applied to non-compulsory programs for children from birth to the age of 6 years. Primary education is compulsory for every Turkish citizen from the age of six to the age of fourteen and is free-of-charge in state schools. The students who graduate from 8 years primary education may take the Secondary Education Selection and Placement Examination (SESPE) to enrol in selective high schools or can continue their studies at a general high school, depending on the graduate's grades of primary education. Secondary education includes two main sectors, which are general high schools and vocational-technical high schools education. Students who graduated from both

types of schools have the right to conduct a University Selection and Placement Examination (USPE) .

3. Conceptual framework

In this section, we first provide a definition and means of operationalising science-related attitudes. Next, we will briefly discuss the structural framework behind the elements of the learning environment studied in this contribution and measured with the WIHIC. Last, we will summarize prior research that has linked student's perceptions on the WIHIC to their (science-related) attitudes.

3.1 Defining and measuring students subject-related attitudes

One of the purposes of the present study is to investigate whether associations exist between the classroom environment and students' attitudes. To find a clear term to define students' affective outcomes has been a difficult task and debated by researchers in the past. In 1979, Peterson and Carlson used the "attitude" term without any clarification with "interest". Evaluative quality is the central attribute of the attitude concept—like or dislike (Shrigley, Koballa, & Simpson, 1988), including terms such as interest, enjoyment, and satisfaction (Gardner & Gauld, 1990) and even curiosity, confidence, and perseverance (Shulman & Tamir, 1972). Shrigley (1983) stated that it is generally agreed that attitude is not innate, but learned as part of culture. Klopfer (1976) alleviated the semantic problems caused by the multiple meanings attached to the term '*attitude toward science*' by developing six categories of conceptually different attitudinal aims. These categories were: manifestation of favourable attitudes to science and scientists; acceptance of scientific enquiry as a way of thought; adoption of scientific attitudes; enjoyment of science learning experiences; development of interest in science and science-related activities; and development of interest in pursuing a career in science (Shulman & Tamir, 1972).

Scientists have developed instruments and a variety of different techniques to assess students' attitudes towards a subject (Laforgia, 1988; Wubbels, Créton, & Hooymayers, 1985). For the present study to evaluate students' attitudes towards their biology classes the *Test of Science Related Attitudes* (TOSRA), developed by Fraser (1981) was selected, due to its widely implementing in previous studies in Western and non-Western countries and its high degree of reliability (Goh, 1994). We will discuss the TOSRA more in detail in the Method section.

3.2 Defining and measuring students' perceptions of their learning environment

Developed by Fraser, Fisher, and McRobbie (1996), the WIHIC measures high school students' perceptions of their classroom environment. The WIHIC measures a wide range of dimensions that are important to the current situation in classrooms. The WIHIC includes relevant dimensions from past questionnaires and combines these with dimensions that measure particular aspects of constructivism and other relevant factors operating in contemporary classrooms. It was designed to bring parsimony in the field of learning environments research (Dorman, 2003). A description of each scale in the WIHIC is presented in Table 1 below.

Table 1

Scale descriptions for each scale in the WIHIC Questionnaire.

WIHIC scale	The extent to which...	Moos dimension
Student Cohesiveness	...students are friendly and supportive of each other.	Relationship
Teacher Support	... the teacher helps, befriends, and is interested in students.	Relationship
Involvement	... students have attentive interest, participate in class and are involved with other students in assessing the viability of new ideas.	Relationship
Investigation	..there is emphasis on the skills and of inquiry and their use in problem-solving and investigation.	Personal growth
Task Orientation	... it is important to complete planned activities and stay on the subject matter.	Personal growth
Cooperation	... students cooperate with each other during activities.	Personal growth
Equity	... the teacher treats students equally, including distributing praise, question distribution and opportunities to be included in discussions.	System maintenance and change

One important consideration that has been part of classroom environment theory since the early 1970s has been Moos' (1979) conceptual framework for human environments that characterises environments as having *relationship*, *personal growth* and *system maintenance and change* dimensions. Whereas relationship dimensions are concerned with the nature and intensity of personal relationships, personal growth dimensions focus on opportunities for personal development and self-enhancement. System maintenance and system change dimensions assess the extent to which the environment is orderly, clear in expectations, maintains control and is responsive to change. Table 1 additionally shows the classification of each WIHIC scale according to Moos' scheme. The instrument itself and its qualities will be discussed more in detail in the Method section.

3.3 Prior research linking the WIHIC to student outcomes

There are not many studies that have investigated the link between students' subject-related attitudes (in terms of the TOSRA) and their perceptions of the learning environment (in terms of the WIHIC), as is the case in the present study. A study by Rawnsley and Fisher (1998) investigated associations between learning environments in mathematics classrooms and students' attitudes towards that subject in Australia using the WIHIC questionnaire. It was found that students developed more positive attitudes towards their mathematics in classes where the teacher was perceived to be highly supportive, equitable, and in which the teacher involved them in investigations.

Chionh and Fraser (1998) used actual and preferred forms of the WIHIC to further validate the instrument and to investigate associations between actual classroom environment and outcomes. The associations between five different outcome measures namely, examination results, self-esteem, and three attitude scales and the seven actual classroom environment scales were investigated in geography and mathematics classrooms in Singapore and Australia. The study revealed that better examination scores were found in geography and mathematics classrooms

where students perceived the environment as more cohesive. It was also found that self-esteem and attitudes were more favourable in classrooms perceived as having more teacher support, task orientation and equity.

Hunus and Fraser (1997) used a modified version of the WIHIC in Brunei, and reported on the associations between perceptions of learning environment and attitudinal outcomes. Simple and multiple correlations showed that there was a significant relationship between the set of environment scales and students' attitudes towards chemistry theory classes. The Student Cohesiveness, Teacher Support, Involvement, and Task Orientation scales were positively associated with the students' attitudes.

A study by Wahyudi (2004) found association between students' outcomes and the status of classroom learning environments. Both simple analysis and multiple regression analysis procedures showed that all scales of the Indonesian WIHIC were statistically significantly positively associated with two scales of the Indonesian adapted TOSRA and students' cognitive scores.

Hoffner-Moss and Fraser (2002) reported that attitudes are particularly favourable in investigative, task oriented and equitable classes in their study with 364 biology students in 18 classes. They also revealed that all students in the study perceived relatively high level of Task orientation.

Allen (2003) reported the results of simple correlation analysis between scales of the WIHIC and TOSRA. In his study, Investigation was significantly correlated with Inquiry. Additionally, Involvement, Task orientation and Investigation were significantly correlated with Enjoyment. All correlations found were positive.

In a cross cultural study conducted with Indonesian and Australian students, Adolphe, Fraser and Aldridge (2003) remarked a reasonably strong and positive association between all the WIHIC scales and the TOSRA scales.

Overall, these findings show that many or all of the WIHIC scales are positively related to student attitudes. High associations have particularly been found for the scales Teacher Support, Equity and Investigation. However, previous studies cannot easily be compared to the present study for a number of reasons. First, many were focused at primary education, while the present study is focused at secondary education. Second, the previous studies were conducted in several subject domains, but few (e.g. Hoffner-Moss, 2003) have been undertaken in the Biology classroom. Third, as mentioned previously, none of the studies has been undertaken in Turkey. Fourth, although the studies were careful in their analyses procedure, they may have overestimated the effects of scales, because they consistently investigated associations between a single WIHIC scale and student attitudes, thus not taking into account the (partially) joint effect of possible other (WIHIC) elements of the learning environment or taking into account the effect of background characteristics of students, teachers or classes that may have affected attitudes and student perceptions as well. The present study hopes to address some of these limitations by including background variables, by investigating the joint effects of all scales, and by doing this on a secondary education biology sample in Turkey.

4. Research questions

In order to obtain a comprehensive image of science classroom environments in Turkish high schools, this study was carried out following objectives:

- To describe students' general perceptions of their biology learning environments
- To explore the demographic and academic background variables that may be related to these students' attitudes toward biology
- To investigate associations between students' perception of their learning environment and their attitudes toward biology

Specifically, the research questions that this study attempted to answer were:

1. Can the *What Is Happening in this Class* (WIHIC) questionnaire be used in a valid and reliable manner with grade 9 and 10 biology students in Bursa and Ankara, Turkey?
2. Are there relationships between biology students' perceptions of their learning environment and their attitudes toward biology?
3. Are there differences in students' attitudes toward biology by gender, grade levels, and parental educational level?

5. Method

5.1 Sample

The participants of this study were 1983 ninth grade and tenth grade students from nine high schools. Data for the study were collected from 57 biology classes[2]. Class size in these schools varied from 30 to 40 students. Schools were selected conveniently from two city centres, Bursa and Ankara, two of the major cities in Turkey. All types of Turkish secondary education (Anatolian high schools, vocational high schools and general high schools) were represented in the sample. The sample (see Table 2) consisted of grade 9 (59.5 %) and grade 10 students (31, 9 %), the majority of which were boys (50.1 %).

Table 2

Number of students by gender and grade level

	Number of Student in Grade 9	Number of Student in Grade 10	Total
Girls	608	254	862
Boys	663	424	1087
Total	1271	678	1749
Unknown	-	-	134

Education level of parents showed a wide distribution from primary school to graduate level in our sample, which is indicated in Table 3.

Table 3

Students' parental education level

[2] Unfortunately, due to a computer problem during the data collection phase of the study, no individual data was recorded for student class and school identification. This means we could only investigate the effect of individual student characteristics and only some effects of class or school background characteristics (for example grade level). Of course, we realise this is a limitation to our study.

Educational Level	Mother Education Level	Percentage (%)	Father Education Level	Percentage (%)
Primary School	714	32.9	422	19.4
Junior High School	322	14.8	321	14.8
High School	553	25.5	589	27.1
Bachelor Degree	299	13.8	507	23.4
Graduate degree	26	1.2	77	3.5
Total	1914	88.2	1916	88.3
Unknown	257	11.8	255	11.7

Since the sample comprised the majority of the secondary education schools in the two cities involved, the sample can be considered representative for these two locations. However, no information is available on how these cities compare to Turkey as a whole.

5.2 Instrumentation

All students responded to two questionnaires: the *What is Happening in This Classroom* (WIHIC) and the *Test of Science Related Attitudes* (TOSRA).

The original version of the WIHIC contained 90 items and nine scales, but was refined by statistical analysis of data from 355 high school science students, and extensive interviewing of students about their views of their classroom environments in general, the wording and salience of individual items and their questionnaire responses (Fraser, Fisher, & McRobbie 1996). Only 56 items in seven scales survived these procedures, although this set of items was expanded to 80 items in eight scales for the field-testing of the second version of the WIHIC, which involved high school science classes in Australia and Taiwan. The Australian sample consisted of 1,081 students in 50 classes who responded to the original English version. The Taiwanese sample of 1,879 students in 50 classes responded to a Chinese version that had undergone careful procedures of translation and back translation (Huang & Fraser 1997). This led to a final form of the WIHIC containing the seven eight-item scales.

Most of the studies using the WIHIC have provided information with respect to both validity and reliability. Research seems to indicate that the reliability of the scales (Cronbach's Alpha) of the instrument is usually above .70 at the student level and above .85 at the class level. Exploratory and confirmatory factor analyses (e.g. Dorman, 2003) indicate that the items of the WIHIC usually have factor loadings above .40 on their *a-priori* scales and lower loadings on other scales. Moreover, the factor structure has been shown to be invariant across grade levels, countries, cultures and gender (Dorman, 2003), which suggests its usefulness in studying multicultural and heterogeneous school populations (as is the case in the present study). Average correlations between the scales of the WIHIC – a convenient measure of discriminant validity (Fraser, 1998) – have been reported between approximately .20 and .50, indicating that each of the seven scales measures distinct, though partly overlapping elements of the classroom environment.

For the present study, the questionnaire was first translated and adapted into Turkish by the first two authors. The next step involved an independent back translation of the Turkish version into English by two qualified, bilingual Turkish graduate students who were not involved in the original translation. Then the Turkish authors of this study checked the back translations and, for

some items, necessary modifications in the Turkish translation were carried out. A pilot study was conducted with 399 eleventh grade high school students. Based on the pilot study results, modifications were made. After this, the instrument was distributed among the classes and students involved in the present study.

The final modified form of instrument was constructed with a five-point Likert-type response scale with the following alternatives: (1) Never, (2) Seldom, (3) Often, (4) Usually, (5) Always. Scale reliability (Cronbach's alpha) for different WIHIC scales ranged from 0.75 to 0.88 (see Table 4) in this Turkish sample.

Table 4

WIHIC scales, sample item, and reliability (Cronbach's Alpha) (N=1983 students).

Scale	Typical item	N items	Alpha (student)
Student cohesiveness	Students in this class like me.	8	.75
Teacher support	The teacher talks with me.	8	.86
Involvement	I discuss the ideas in class.	8	.80
Investigation	I carry out investigation to test my ideas.	8	.86
Task orientation	I do as much as I set out to do.	8	.81
Cooperation	I learn from other students in this class.	8	.83
Equity	My work receives as much praise as other student's work.	8	.88

In Table 5, WIHIC scale intercorrelations are displayed. As can be seen, all scales are positively related, meaning that if students have higher perceptions of one element of their learning environment, they also tend to see more of the other elements of the learning environment. Nevertheless, correlations rarely exceed .50, and the average scale correlation between one WIHIC scale and the other scales ranges between .34 (Student Cohesiveness) and .44 (Involvement). These are indications that the scales of the instrument measure distinct elements of the learning environment and only display partial overlap.

Table 5

WIHIC scales correlations and average correlation.

	Cohes	Supp	Involv	Invest	Taskor	Coop	Average correlation
Cohes							.34
Supp	.23						.36
Involv	.43	.43					.44
Invest	.25	.39	.49				.40
Taskor	.28	.34	.35	.51			.39
Coop	.54	.32	.47	.40	.38		.42
Equit	.29	.47	.44	.38	.50	.42	.42

Note: all correlations were significant at p=.01. Cohes=Student Cohesiveness; supp=Teacher Support, involv=-Involvement; invest=Investigation; taskor=Task Orientation; coop=Cooperation; equit=Equity.

The second questionnaire used in this study is the *Test of Science Related Attitudes* (TOSRA). It is originally consisted of 7 scales and 70 items and was developed by Fraser (1981). The seven original scales were: social implications of science, normality of scientists, attitude to scientific inquiry, adaptation of scientific attitudes, enjoyment of science lessons, leisure interest in science, career interest in science. Each of the seven scales included 10 items. The TOSRA-items are scored on a 5-point scale, ranging from strongly agree (5) to strongly disagree (1).

Since we were mainly interested in subject-related attitudes, rather than in the more general concept of science-related attitudes, four scales from the original form of the TOSRA were selected: *attitude to scientific inquiry*, *enjoyment of science lessons*, *leisure interest in science*, and *career interest in science*. These four scales of the questionnaire were translated and adapted, similar to the procedure for adaptation of the WIHIC questionnaire. After the before mentioned pilot study, a factor analysis was run and necessary modifications, such as deleting some of the items, were made. The final modified version of the TOSRA for the Turkish context in the present study (T-TOSRA) included 32 items (see Table 6).

Table 6
Scales and short scale description for the T- TOSRA Questionnaire.

Scale	Scale description
attitude to scientific inquiry	Acceptance of scientific inquiry as a way of thought
enjoyment of science lessons	Enjoyment of science learning experiences
Leisure interest in science	Development of interest in science and science related activities
Career interest in science	Development of interest in pursing a career in science

Similar to the WIHIC questionnaire, we conducted some analyses on the TOSRA scales to check for their reliability and construct validity. In Table 7, a sample item is presented for each TOSRA scale. Moreover, we have investigated scale reliability by computing Cronbach's Alpha. As can be seen, all of the TOSRA scales were sufficiently reliable (e.g. above .70).

Table 7
TOSRA scales, sample item and reliability (N=1983 students).

Scale	Sample item	N items	Alpha (student)	Mean	St. dev.
Inquiry	I would prefer to do experiments than to read about them.	8	.71	.61	.17
Enjoyment	Science lessons are fun.	10	.89	.61	.21
Leisure	I would like to belong to a science club.	8	.80	.55	.20
Career	Working in a science laboratory would be an interesting way to earn a living.	5	.75	.50	.21

Note: 5-points scales were transformed into a score between 0 and 1.

To check whether TOSRA scales measured sufficiently different concepts, we computed scale intercorrelations (see Table 8). It seemed that three out of four scales displayed some overlap (average correlations ranged between .49 and .54), while the Inquiry scale was least connected to the other scales (average correlation was .16).

Table 8

T-TOSRA scales, intercorrelations.

	Inquiry	Enjoyment	Leisure	Average correlation
Inquiry				.16
Enjoyment	.09			.49
Leisure	.19	.73		.54
Career	.19	.64	.69	.51

Note: all correlations were significant at p=.01.

5.3 Analyses

To investigate how individual students' attitudes were related to their personal perceptions of the learning environment, we first computed simple correlations between the TOSRA scales and the WIHIC scales. As a second step, we performed regression analyses on the TOSRA scales, using WIHIC scales as independent variables. To correct the effect of the learning environment for other covariates, we also entered some background variables into these regression analyses. These variables were: student gender, grade level, and socio-economic background. The latter variable was measured in terms of education level of the father and education level of the mother. Grade level was recorded into a binary variable, with a 1 indicating grade 9 (and a 0 grade 10). Gender was recoded into a binary variable, with boys represented by a 1 and girls by a 0. Education level (of both parents) was measured in terms of 5 categories, with a 5 representing the University level and a 1 indicating no education at all. To test overall fit of the regression models we computed an F-value (and its significance) as well as the percentage of variance explained by the model. We used the 'enter' method, meaning that the computer entered variables into the model in order of their effect size up to the point that variables added no significant amounts of variance to the model.

6. Results

As can be seen in Table 9, on average, Turkish students perceive their classes as highly task oriented, moderately cohesive, cooperative and equitable, but less teacher supportive, leading to involvement or stimulating investigation. The average class profile is similar to the profile displayed in Australia and the United States, where also high ratings are reported for Student Cohesiveness, Task Orientation and Equity. Nevertheless, it seems the students are slightly more moderate in their responses, as differences between scale means are smaller than in the United States.

Table 9

Turkish students' mean perceptions on the WIHIC scales (standard deviation), mean perception scores in the USA and Australia.

WIHIC scale	Mean perception (standard deviation) Turkey (N=1983)	Mean perception USA (source: den Brok, et al., in press) (N=655)	Mean perception Australia (source: Rawnsley & Fisher, 1998) (N=490)
Student Cohesiveness	.69 (.16)	.74	.58
Teacher Support	.46 (.22)	.43	.58
Involvement	.55 (.18)	.46	.50
Investigation	.54 (.20)	.41	.40
Task Orientation	.75 (.17)	.78	.68
Cooperation	.59 (.19)	.68	.63
Equity	.66 (.21)	.64	.68

Note: the original studies reported their scale means as a score between 1 and 5, for the present study these scores were linearly transformed to a score between 0 and 1.

Looking at the standard deviations, it seems that Turkish students disagree most on Teacher Support, Investigation and Equity.

According to Table 7, Turkish high school students have moderate science attitudes (e.g. their scores are just above the scale medium score of .50 or 50 percent). They are most favourable about Enjoyment and Inquiry in Biology, and least favourable about the prospect Biology has for their career. Also, looking at the standard deviations, it appears there is quite some variation in students' attitudes with respect to the Inquiry, Leisure and Career scales.

Table 10 provides simple correlations between the attitude scales and the learning environment scales in this study. In all instances, the raw correlations are positive, suggesting a positive effect of perceptions of the learning environment on subject-related attitudes. Highest correlations can be found for Involvement (around .20), Investigation (between .26 and .42) and the lowest correlations can be found for Student Cohesiveness (around .10). Students' perceptions of the learning environment seem least related to Inquiry and most to Leisure. Perceptions of Teacher Support, Task Orientation and Equity are variably related to students' attitudes: low associations are found with Inquiry, but much higher associations are found with Enjoyment, Leisure and Career.

Table 10
Simple correlations between TOSRA and WIHIC scales (N=1983).

	Inquiry	Enjoyment	Leisure	Career
Cohesiveness	.14	.13	.13	.10
Teacher support	.05 *	.33	.30	.22
Involvement	.21	.21	.22	.18
Investigation	.26	.36	.42	.32
Task orientation	.09	.39	.40	.32
Cooperation	.16	.16	.19	.14
Equity	.07	.32	.28	.19

Note: *=non-significant at p=.025 (two-sided).

Interestingly, the pattern of associations changes somewhat if covariates are included in the analyses and if associations are studied taking into account the effect of the other learning environment scales of the WIHIC (see Table 11). It seems that Investigation remains positively and significantly associated with each of the four attitude scales. However, the association of Involvement with students' attitudes diminishes or even disappears. Negative relationships are even found between Teacher Support and Inquiry – which seems logical: the more teachers play a role in the learning process, the less chance there is for the students to do so –between Cooperation and Enjoyment, and between Cooperation and Career prospect. Task orientation also seems positively related to three out of four attitude scales (an exception is Inquiry).

Table 11
Regression analyses on TOSRA scales (N=1983).

Variables	Inquiry	Enjoyment	Leisure	Career
WIHIC scales:				
- cohesiveness	.08	-	-	-
- teacher support	-.08	.19	.10	.09
- involvement	.10	-	-	-
- investigation	.27	.16	.26	.21
- task orientation	-	.23	.24	.16
- cooperation	-	-.11	-	-.09
- equity	.08	.08	-	-
Background variables:				
- grade level	.08	.12	-	.10
- gender	-	-	-	-.09
- educ level mother	-.10	-	-.07	-.09
- educ level father	-	.12	-	-
Total model fit:				
- F-value	26.05	58.57	97.15	35.12
- Significance	.00	.00	.00	.00
- % explained	13.3	25.4	24.4	16.8
-				

Note: coefficients are standardized (beta-weights). Only significant coefficients (at p=.01) are displayed.

Table 11 also shows that younger students (grade 9) have more positive attitudes than older students (grade 10). Girls seem to have less positive attitudes in terms of Career than boys. Education level of the mother is negatively associated with 3 out of 4 attitude scales, education level of the father positively related to Enjoyment. The models explain 13 up to 25 percent of the variance, which is quite impressive.

7. Discussion

This study provided insights into biology classroom environment in high schools in Bursa and Ankara, two of the major cities in Turkey. This study is a pioneering study for Turkey in the domain of learning environments research in some respect. It has shown that the WIHIC is a valid a reliable instrument for use in the Turkish secondary education context.

The results of the study indicated that participating high school students had moderately favourable attitudes of their learning environment in biology, with higher ratings for Inquiry and

Enjoyment than for Career. The somewhat higher ratings found for Inquiry and Enjoyment can be the result of the presence of students from Anatolian (e.g. more cognitively oriented) high schools, who have a high(er) tendency to follow science courses and usually have higher examination scores. Their high achievement may also lead to relative high enjoyment. The lowest ratings on the Career scale can be the result of many things. A possible explanation might lie in the fact that in Turkey, occupations related with this subject usually require longer and more concentrated education with a heavy curriculum involving many other subjects, resulting in a relative downplay of Biology itself, and causing many students not to go for such occupations.

It was also found that some elements of the learning environment (e.g. Student Cohesiveness, Task Orientation and Equity) were perceived as more visible than others. Although the average perceptions did not differ from those reported in other countries (e.g. den Brok, et all., in press; Rawnsley, & Fisher, 1998), we will still try to interpret them with the Turkish educational context in mind. In Turkey, generally teachers have limited time to pay personal attention to their students due to large (average) class sizes. This may be a cause for the relatively low score on Teacher Support. In a similar fashion, it can be argued that due to the large class size, the time for each student to participate the lesson is limited. Besides this, the main concern of many Turkish teachers is to cover the curriculum on time. Therefore, to some degree, the relatively low rating for Involvement is not very surprising. Since Turkish students are very much inclined to pass their exams, and because there is high pressure from society and parents on students to be successful, this may explain why students are inclined to be highly task oriented and may perceive their environment as such.

Additionally, it was found that younger students, boys and higher socio-economic background of the father (but lower background of the mother) were more positively associated with student's subject-related attitudes in Biology. Usually, in (Turkish) society science is approached from a masculine perspective and many science related occupations are dominated by males. In this respect, Turkey is no exception. This general trend may affect girls' career preference negatively and reduce their motivation for subjects such as Biology. Furthermore, gender has been found to be a significant factor that differentiates students' perceptions of biology learning environments. For example, according to Mok (2002), female students had both higher developmental expectations of their schools and more positive perceptions of the classroom atmosphere. Outcomes of grade level point out that younger students (grade 9) have more positive attitudes than older students (grade ten). Biology curriculum at grade nine in Turkey is lighter than grade ten and student generally spend less effort to follow the lessons. The topics in grade ten are more concentrated and students have to reserve many hours addition to class hours to follow lessons. It is usually boring and exhausting for students to have so many hours of science per week with such an intensive curriculum. Additionally, they are feeling more pressure for the University Selection and Placement Examination (USPE) at this grade since time is getting closer than the previous year.

Finally, when all variables are included in the analyses, it seemed perceptions of Investigation were most strongly and positively related to students' attitudes, followed by Task Orientation. The teacher's limited time for students on an individual base may stimulate the development of students' investigation skills and perceptions of the learning environment stimulating this. As long as students are finding out by themselves, it seems their interest and

attitudes may develop positively toward the subject. Interestingly, when all other elements are considered, Cooperation contributes negatively, as does Teacher Support on Inquiry.

More generally, this study also replicated the finding that there is a strong link between student outcomes and their perceptions of the learning environment (Fraser, & Fisher, 1982; den Brok, Brekelmans, & Wubbels, 2004; Wubbels & Brekelmans, 1998). More specifically, the findings are similar to those of other studies using the WIHIC and TOSRA (e.g. Adolphe, Fraser, & Aldridge, 2003; Allen, 2003; Chionh, & Fraser, 1998; Hoffner-Moss, 2003; Hunus, & Fraser, 1997; Rawnsley, & Fisher, 1998; Wahyudi, 2004). In particular, previous findings were replicated with respect to the positive associations with the Investigation and Task Orientation scales. However, the study also showed that including background variables of students and taking into account the effect of other environment variables may downplay the additional or separate effect of scales, due to their overlap with these variables. As such, it is important for learning environments researchers to take these factors into account.

The first limitation of the study is the fact that multilevel analysis could not be performed. This could have helped to report and explain some of the educational processes at the class level, which have not come into view at this point. These processes include effects of such variables as class size and teacher on the average attitudes of the students within one class. The study at this point only attempted to explain individual student attitudes from a personal point of view. Because class level variables were not included, the effect of learning environment perceptions has only been adjusted for some background characteristics. Moreover, other elements of the learning environment, such as teacher interpersonal behaviour, for example, have not been included Moreover, there is no clue as to what amount of the differences between students is actually to be found at the class, teacher, school or even region level. Consequently, some of the effects reported in this study may have been overestimated. Second, the sample is relatively small and only covered a small part of Turkey. Therefore, results cannot be easily generalized to the country as a whole, and future research with larger samples from different cities will be necessary to shed light on this point. Such research could also confirm (or reject) some of the associations found in the present study. Last, although the focus on affective outcomes is considered relevant and important, of course this study cannot tell anything about the associations between the learning environment and other outcome measures (e.g. achievement). This might be another avenue for future research in Turkish learning environments research.

The classroom is the basic unit of organization of the Turkish educational system. By continuing to increase our knowledge of the interactions that occur within the classroom, we shall be able to enhance our understanding of this important educational unit. As we increase our understanding of how students, teachers and science come together within the classroom environment, we should be able to improve the quality o science education in Turkey. It has been assumed that having a positive classroom environment is an educationally desirable end in its own right. This study provides biology teachers with information about aspects of the learning environment that, if altered, could lead to increases in students' attitudinal and achievement gains. The practical implication of this research is that student outcomes might be improved by creating classroom environments found empirically to be conducive to learning. Understanding students' perceptions of their classroom learning environments and the factors associated with their perceptions may help us to find out some alternative ways that enhance the student's learning.

Findings of this study identified gender, grade levels, and parental educational level variables as factors that predict learning environment perceptions. For that reason, educational researchers in Turkey should focus on the disparities between boys and girls and find strategies that may create positive and productive learning environment for boys. Furthermore, educators should recognize the importance of creating supportive, stimulating, enjoyable and productive learning environment by considering the types of schools. In addition to these affect of parental educational level on student's attitudes and perceptions can be studied on further studies.

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