Foreign Educational Tradition
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PSYCHOSOCIAL ENVIRONMENT OF CHEMISTRY LABORATORY CLASSROOMS IN IRANIAN HIGH SCHOOLS

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Abstract. This study investigates the learning environment of chemistry laboratory classrooms in Iranian high schools. Science Laboratory Environment Inventory (SLEI) was carefully translated into Persian and administered to 748 (M= 325 and F=423) Iranian high school students. Data analyses attested to the sound factorial validity and internal consistency reliability of the Persian version of SLEI. Comparison of Iranian high school students' scores on actual and preferred forms of the questionnaire revealed that students were not satisfied and preferred a more positive chemistry laboratory environment on all scales. Furthermore, this study proposes some measures that could be taken to improve high school chemistry laboratory classrooms environments. The results will be of significance for chemistry educators to create more efficient and learner-centered chemistry laboratory classrooms environments. The work is distinctive since it is the first learning environment study delving through chemistry laboratory classrooms in Iran.

Keywords: learning environments research, Science Laboratory Environment Inventory (SLEI), Iranian chemistry laboratory classrooms, satisfaction

Introduction

An important and valid source of information regarding the efficiency of science laboratories can be obtained by using measures that assess students' perceptions of the laboratory learning environment. The need to assess the students' perceptions in the science laboratory was first approached by a group of science educators in Australia (Fraser et al., 1993) that developed and validated the Science Laboratory Environment Inventory (SLEI). The SLEI has five scales (each with seven items) and the five response alternatives are Almost Never, Seldom, Sometimes, Often and Very Often. This instrument was found to be sensitive to different approaches to laboratory work and in different science disciplines such as biology or chemistry laboratory learning environments (Hofstein et al., 1996; Fisher et al., 1999).

The SLEI has been used in several studies conducted in different parts of the world. One comparative study examined students' perceptions in six countries: UK, Nigeria, Australia, Israel, USA, and Canada (Fraser & McRobbie, 1995). Fraser et al. (1993) in Australia, found that students' perceptions of the laboratory learning environment accounted for significant amounts of the variance of the learning beyond that due to differences in their abilities.

In spite of internationalization of learning environment studies and vast arrays of research in science laboratory learning environments, few studies could be located that report some explorations regarding Iranian students' perceptions of their learning environments. This study, after validating a Persian version of the SLEI, tries to delve into Iranian high school students' satisfaction with their chemistry laboratory learning environments. It also tries to spot the chemistry laboratory environment dimensions that lead to Iranian high school students' dissatisfaction. The work is unique since it is the first of its type in Iran.

Field of learning environments research

The pioneering works of two American scholars, Rudolf Moss and Herbert Walberg paved the way for the field of learning environments research. Through the evaluation of the Harvard Physics Project, Walberg & Anderson (1968) developed the Learning Environment Inventory (LEI). Working in a quite separate field, Moos (1968) developed a number of social climate scales, including those for use in correctional institutions and psychiatric hospitals (Moos & Houts, 1968). These instruments led to the development of the Classroom Environment Scale (CES) (Trickett & Moos, 1973).

Interest in the concept of learning environments then spread. Fraser (1998a) states that the quality of the classroom environment in schools is a significant determinant of student learning and students' positive perceptions of learning environments will pave the way for better and deeper learning. Numerous research studies have shown that student perceptions of the classroom environment account for appreciable amount of variance in learning outcomes, often beyond that attributable to background student characteristics (Dorman, 2001).

Decades of research in the field of learning environments have led to the development of a variety of economical, valid and widely-applicable questionnaires for assessing students' perceptions of classroom environments. There are now hundreds of researches which explore learning environments at various grade levels (primary, secondary, tertiary) and in a variety of contexts and classrooms including science and mathematics, chemistry, computer, biology, geography, physics and language.

Studies on science and mathematics classroom environments have a long tradition in the field and studies such as Yang et al. (2002), Wolf & Fraser (2008), and Aldridge &

Fraser (2000) focused on science and mathematics learning environments with the aim of promoting these environments. Chemistry classroom environments have also been the target of exploration in different studies (e.g.,Hofstein et al. 1979; 1996; McRobbie & Fraser, 1993; Wong et al. 1997; Riah & Fraser, 1998). Studies such as Soerjaningsih et al. (2001) and Maor & Fraser (1996) provide insightful ideas about the nature and promotion of computer classrooms environments. Fisher et al. (1995) focused on biology classroom environments. Geography is another subject area which has been explored in a number of learning environment studies (e.g., Fraser & Chionh, 2000). Psychosocial environments of physics classrooms have also been the subject of studies such as McRobbie et al. (1997) and Terwel et al. (1994).

This study is among those ones that report evaluation, exploration or promotion of chemistry laboratory learning environments.

The growth of learning environment studies can also be viewed from another perspective. Interest in learning environments spread from the USA to The Netherlands where it was picked up by Theo Wubbels and colleagues (Wubbels & Brekelmans, 1997; 1998; 2006), and to Australia, where it was carried forward by Barry Fraser (Fraser 1998a; 1998b; 2007). Learning environment research has since spread further afield to Asia (Fraser, 2002) and South Africa (Aldridge et al., 2006).

One of the most significant contributions of Wubbels and colleagues in The Netherlands was the development of the Questionnaire on Teacher Interaction (QTI) (Wubbels et al., 1997) because interpersonal relationships between students and teachers are such important aspects of the learning environment (Wubbels & Brekelmans 1998).

In Australia, Fraser and colleagues initially elaborated the Individualized Classroom Environment Questionnaire (ICEQ) (Fraser, 1990), but this was followed by other widely used instruments such as the Science Laboratory Environment Inventory (SLEI), Constructivist Learning Environment Survey (CLES) and the WIHIC (Fraser, 1998b).

In Asia, the study of learning environments has been undertaken in Indonesia (Soerjaningsih et al., 2001), Taiwan (Aldridge et al., 1999), Singapore (Khoo & Fraser, 2008; Wong et al., 1997), Brunei (Scott & Fisher, 2004), Korea (Kim et al., 2000; Lee et al., 2003), Japan (Hirata & Sako 1998), India (Koul & Fisher, 2005), and Thailand (Puacharearn, 2004). It should be noted that this study is the first learning environment research concerning chemistry laboratory settings in Iran.

Chemistry laboratory settings

Laboratory activities have long had a distinctive and central role in the science curriculum and science educators have suggested that many benefits accrue from engaging students in science laboratory activities (Lunetta, 1998; Hofstein & Lunetta, 2004).

It is true that very often research has failed to show a simplistic relationship between experiences provided to the students in the laboratory and learning science (Hofstein, 2004). However, sufficient data do exist to suggest that the laboratory instruction is an effective and efficient teaching medium to attain some of the goals for teaching and learning science. Appropriate laboratory activities can be effective in helping students construct their knowledge (Gunstone, 1991), develop logical and inquiry-type skills, as well as problem-solving abilities. They can also assist in the development of psychomotor skills (manipulative and observational skills). In addition, they have a great potential in promoting positive attitudes and in providing students with opportunities to develop skills regarding cooperation and communication. In this respect the science laboratory is a unique learning environment. Thus, it has the potential to provide science teachers with opportunities to vary their instructional techniques and to avoid a monotonous classroom learning environment (Hofstein, 2004).

Appropriate laboratory activities can be effective in promoting cognitive skills, metacognitive skills, practical skills, and attitude and interest towards chemistry, learning chemistry, and practical work in the context of chemistry learning (Hofstein, 2004). In addition, it is clear that providing students with authentic and practical learning experiences has the potential to vary the classroom learning environment and thus to promote students motivation to study chemistry.

This study tries to explore students' perceptions of chemistry learning environments and aims to provide science educators with students' perspectives about these laboratory environments. The results could be of great importance in creating more learner-centered, innovative, creative, critical and democratic chemistry laboratory environments.

Chemistry laboratories in Iranian high schools

Not much has been written about chemistry laboratories in Iranian high schools. The few existing studies argue that the situation is not satisfactory and they call for urgent actions. The following ideas have been mentioned as the reasons of such inefficiency: (i) lack of enough equipment; (ii) excessive attention to theoretical ideas in a way that experimental procedures and laboratories seem unimportant; (iii) lack of interest among instructors to integrate or emphasize laboratory in their teaching process. This can be due to unfamiliarity with laboratory techniques and lack of a knowledge that can meet the requirements of rapidly growing technology; (iv) high prices of materials needed to conduct experiments. During the interviews we had with chemistry laboratory instructors and students, some other ideas were mentioned that seem of interest; (v) some instructors stated that the laboratory classes are overcrowded in a way that individual engagement is almost impossible for students; (vi) some students mentioned that the things they do in the laboratories are not genuine experiments but following the procedures that exist

in the pamphlets they are given at the beginning of the semester; (vii) laboratories are managed in a way that self-directed research-based laboratory experiments for students are impossible; (viii) the theories taught in chemistry classes have little to do with the experiments conducted in laboratories; (ix) it is the existing materials and equipments that specify which experiments are going to be done in the laboratories.

This study, being the first learning environment study in chemistry laboratories in Iranian high schools, can provide significant ideas to promote chemistry laboratories in Iranian high schools. It tries to specify which dimensions of current chemistry laboratory environments students are dissatisfied with.

About the SLEI

The SLEI was developed to assist researchers and teachers to assess science laboratory learning environments (Fraser & McRobbie, 1995). The initial version of the SLEI contained 72 items altogether, with 9 items in each of eight scales. However, extensive field-testing and instrument validation later led to a more economical and valid final version with 35 items, with 7 items in each of five of the original scales. Each item's response alternatives are Almost Never, Seldom, Sometimes, Often, and Very Often. The scoring direction is reversed for approximately half the items. A typical item in the actual form of the Student Cohesiveness scale is: "Students in this laboratory class get along well as a group." The wording of the preferred version is almost identical except for the use of such words as "would." For example, the item "Our laboratory class has clear rules to guide student activities" in the actual version is reworded in the preferred version to read "Our laboratory class would have clear rules to guide student activities."

SLEI assesses five dimensions of the actual and preferred climate of science laboratory classes at the upper secondary school and higher education levels. Noteworthy features of the SLEI include its consistency with the literature, specific relevance to science laboratory classes, salience to science teachers and students, and economy of administration and scoring time.

The SLEI was field-tested and validated with cross-national samples consisting of 3727 upper secondary school students in 198 classes and 1720 university students in 71 classes from six countries (Canada, Australia, USA, England, Israel, and Nigeria). Item and factor analyses led to a refined version with satisfactory internal consistency reliability and factorial validity in both its actual and preferred versions.

The five scales of the SLEI include Student Cohesiveness, Open-endedness, Integration, Classroom Norms, and Material Environment. Student Cohesiveness assesses the extent to which students know, help, and are supportive of one another; Open-endedness assesses the extent to which laboratory activities emphasize an open-ended, divergent approach to experimentation; Integration assesses the extent to which labora-

tory activities are integrated with non-laboratory and theory classes; Classroom Norms assesses the extent to which behavior in the laboratory is guided by formal rules; and Material Environment assesses the extent to which laboratory equipment and materials are adequate. By writing new items and rewriting existing ones, the authors redefined and modified scales selected from inventories for non-laboratory settings to suit them to science laboratory classes. They based further revisions of items on reactions from colleagues with expertise in questionnaire construction and in science teaching at the secondary and higher education levels, paying careful attention to suit item each for measuring both actual and preferred classroom environments.

Development of the Persian version of SLEI

A contextual, rather than textual, translation of the original version of the SLEI was undertaken. Since the study is just concerned about chemistry laboratory, the phrase "science laboratory" in the original SLEI was translated into "chemistry laboratory" in the Persian version.

Since the original instrument was designed for Western students, with all statements in English, careful translation and back translation as suggested by Brislin (1970) was carried out. After translation into Persian, an independent person who was fluent in both English and Persian conducted a back translation into Persian to investigate whether or not the translation had captured the original meaning. The Persian version of the SLEI has five scales with seven items per scale. All items are scored on a five-point frequency scale with Almost Never representing the most negative perception and Almost Always representing the most positive perception.

The Persian version of the SLEI was then distributed among 748 (M=325 and F=423) Iranian high school students in 30 chemistry laboratory classes in 27 high schools in Shiraz, Marvdasht, Arsanjan, Bandarabbas, Yasouj and Saadatshahr. The number of students in each class ranged from 21 to 30.

Field testing and validation of the Persian version of SLEI

The students' responses to the Likert scale including almost never, seldom, sometimes, often and very often alternatives, were scored 1, 2, 3, 4 and 5, respectively. The data were analyzed through SPSS and various analyses were conducted to check factorial validity and internal consistency reliability of the Persian version of SLEI.

Two statistical measures were also generated by SPSS to help assess the factorability of the data: Bartlett's test of sphericity and Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (Pallant, 2005). For the factor analysis to be considered appropriate, the Bartlett's test of sphericity should be significant ($p<0.05$). The KMO index ranges from 0 to 1 and the minimum value for a good factor analysis is 0.6 (Tabachnick & Fidell, 2001).

Table 1. Factor loadings from confirmatory factor analysis (for the actual form of the SLEI)

ITEM	Factor Loading				
	SC	OP	IN	CN	ME
A1	.816				
A2	.564				
A3	.456				
A4	.674				
A5	.532				
A6	.589				
A7	.620				
A8		.499			
A9		.674			
A10		.509			
A11		.628			
A12		.694			
A13		.674			
A14		.671			
A15			.724		
A16			.647		
A17			.487		
A18			.609		
A19			.738		
A20			.582		
A21			.691		
A22				.546	
A23				.756	
A24				.564	
A25				.487	
A26				.732	
A27				.628	
A28				.539	
A29					.564
A30					.593
A31					.693
A32					.601
A33					.569
A34					.673
A35					.487

Note. SC = Student Cohesiveness; OP = Open-endedness; IN = Integration; CN = Classroom Norms; ME= Material Environment

Table 2. Factor loadings from confirmatory factor analysis (for the preferred form of the SLEI)

ITEM	Factor Loading				
	SC	OP	IN	CN	ME
P1	.673				
P2	.587				
P3	.608				
P4	.596				
P5	.622				
P6	.598				
P7	.456				
P8		.665			
P9		.723			.453
P10		.459			
P11		.693			
P12		.409			
P13		.674			
P14		.738			
P15			.772		
P16			.756		
P17			.562		
P18			.629		
P19			.587		
P20			.693		
P21			.769		
P22				.654	
P23				.603	
P24				.575	
P25				.487	
P26				.462	
P27				.632	
P28				.672	
P29					.564
P30					.738
P31					.672
P32					.562
P34					.525
P35					.486

Note. SC = Student Cohesiveness; OP = Open-endedness; IN = Integration; CN = Classroom Norms; ME= Material Environment

The KMO index was higher than 0.6 (.821 and .865 for actual and preferred forms respectively) and the result of the Bartlett's test of sphericity was significant (p=0.00). These two measures also attested to the factorability of the data for factor analysis.

Factor analysis

One of the most important considerations in the field of learning environment research is the choice of unit of analysis. In the present study, validation of data has been provided for the individual as unit of analysis. Use of the individual as the unit of analysis can provide spurious results because an unjustifiably small estimate of the sampling error is employed in tests of statistical significance (Dorman, 2001).

By using SPSS, principal component analysis with varimax rotation led to the generation of orthogonal factors. Past research suggested that the SLEI had a five-factor structure. This number of factors was retained for the Persian version of SLEI and confirmatory factor analysis was used.

The results of factor analyses for actual and preferred forms are provided in Tables 2 and 3, respectively. Loadings of less than 0.30, a commonly used cut-off, have been eliminated. As it can be seen from Tables 1 and 2, all items load strongly on their hypothesized scale. There are two exceptions, however. Item number 9 in the preferred form has loadings greater than 0.30 on scales other than a priori assigned scale. Nevertheless, overall, this study provides support for the a priori five-factor structure of the final version of the Persian version of SLEI; nearly all items have a factor loading of at least 0.3 on their a priori scale. It is acceptable to maintain all 35 items of five scales in this questionnaire for further analysis.

Internal consistency reliability of the Persian version of SLEI

Table 3 reports the internal consistency (alpha reliability coefficient) for the validated 35-item version of the Persian version of SLEI, with separate reports for actual and preferred forms and for the use of the individual student as the unit of analysis. Table 3 suggests that each scale of the Persian version of SLEI has acceptable internal consistency in all cases.

Differences between actual and preferred learning environment

Data collected using the Persian version of SLEI were used in a research application involving investigation of whether there were differences between students' actual and preferred classroom environment scores on the scales of Student Cohesiveness, Open-endedness, Integration, Classroom Norms, and Material Environment.

The average item mean and average item standard deviation were calculated for each actual and preferred scale of the refined the Persian version of SLEI for the individual as the units of analysis.

Table 3. Internal consistency reliability (Alpha coefficient) for actual and preferred forms and for individual as the unit of analysis

Scale	Alpha Reliability	
	Actual Form	**Preferred Form**
Student Cohesiveness	.66	.68
Open-endedness	.72	.74
Integration	.82	.84
Classroom Norms	.72	.71
Material Environment	.79	.82

Table 4. The results of different paired-sample T-tests between the scores of all participants on the five dimensions of actual and preferred forms

		PAIRED DIFFERENCES					t	df	**sig. P<0.05**
		Mean dif	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	SC(Actual) - SC(Preferred)	-.75	1.18	.043	-.839	-.669	-17.3	747	**.000**
Pair 2	OP(Actual) – OP(Preferred)	-1.1	1.24	.045	-1.20	-1.02	-24.5	747	**.000**
Pair 3	IN(Actual) – IN(Preferred)	-.60	.851	.031	-.669	-.547	-19.5	747	**.000**
Pair 4	CN(Actual) – CN(Preferred)	-.45	.954	.034	-.520	-.383	-12.9	747	**.000**
Pair 5	ME(Actual) - ME(Preferred)	-.81	1.13	.041	-.898	-.736	-19.7	747	**.000**

The five pairs of scores were computed through SPSS for conducting different paired-sample t-tests between the scores of the same scales of the actual and preferred forms. The results of these paired-sample t-tests are provided in Table 4. As it is clear, there are significant differences ($p<0.05$) between scores on Student Cohesiveness, Open-endedness, Integration, Classroom Norms , and Material Environment dimensions in the actual and preferred classroom environments.

Overall the results reported in this section clearly reveal that students preferred a more positive classroom environment than the one that they perceived as being actual-

ly present in terms of the five dimensions of Student Cohesiveness, Open-endedness, Integration, Classroom Norms, and Material Environment. These differences between students' actual and preferred environments in our study in Iran are consistent with past research which has explored the congruence between actual and preferred environments in a number of countries around the world (Fisher et al., 1995; Yarrow et al., 1997).

The measures that could be taken

The results of this study can be of interest and significance for those educators searching for new ways of looking at chemistry laboratory education. By taking into consideration the dissatisfaction of our learners and also the deficiencies currents classroom environments bring about, the necessity of change and reform in our educational context will be revealed. We should give our learners what they want and create environments in which learning takes place more efficiently. Chemistry laboratory classroom environments in Iranian high schools should change so that classroom activities and knowledge can be relevant to students' everyday out-of-school experiences (i.e., Personal Relevance) and opportunities are provided for students to experience that knowledge is evolving and culturally and socially determined (i.e., Uncertainty). Chemistry laboratory classrooms should be redesigned so that students can share with the teacher control for the design and management of learning activities, assessment criteria, and social norms of the classroom (i.e. Student Negotiation). High school chemistry laboratory classroom environments should be changed so that students have opportunities to explain and justify their ideas, and to test the viability of their own and other students' ideas (i.e., Shared Control). We should adopt environments in which students feel that it is legitimate and beneficial to question the teachers' pedagogical plans and methods (i.e., Critical Voice).

Conclusion

This study, for the first time, tried to investigate chemistry laboratory classroom environments in Iranian high schools. A Persian version of SLEI was validated and used to assess Iranian high school students' perceptions of their chemistry laboratory classroom environments. With the premise that "the greater the degree of concordance between one's ideal classroom and the actual classroom within which one finds oneself, the greater the degree of satisfaction there is likely to be" (Williams & L.Burden, 1998), the results showed that chemistry laboratory classroom environments in Iranian high schools are not in line with Iranian high school students' interests and preferences. Suggestions were also made to help Iranian chemistry practitioners improve these classrooms environments.

The Persian version of the SLEI provided in Appendix will both motivate and facilitate the growth of learning environment research in chemistry laboratory learning environments in Iran. In particular, there is scope for future research with this instrument

which replicates common lines of past research such as: exploration of associations between student outcomes and classroom learning environment (Wong et al., 1997); using learning environment scales as dependent variables in studies of determinants of classroom environment (Aldridge & Fraser, 2008); using feedback on students' perceptions of actual and preferred learning environment to direct improvements in classrooms (Aldridge et al., Fraser, & Sebela, 2004); and use of learning environment criteria in assessing educational programs (Wolf & Fraser, 2008).

High school students' views on chemistry laboratory classrooms environments are of value as the windows to the world of classrooms. They are not satisfied with their chemistry laboratory classrooms environments and changes seem necessary.

APPENDIX:
The actual and preferred forms of the Persian version of SLEI

Note: Items number 1, 6, 11, 16, and 21 are related to Integration scale, items number 2, 7, 12, 17, and 22 are related to Open-endedness scale, items number 3, 8, 13, 18, and 23 are related to Integration scale, items number 4, 9, 14, 19, and 24 are related to Classroom Norms scale and items number 5, 10, 15, 20, and 25 are related to Material Environment scale.

The actual form of the Persian version of SLEI

ابيرقت هشيمه	ابلاغ	يهاگ تاقوا	هب تردن	ابيرقت زگره	
					1. بلاق رد يبوخ هب يميش هاگشيامزآ ياه سالك رد نايوجشناد دنزادرپ يم تيلاعف هب هورگ.
					2. رد ات دنراد ار تصرف نيا يهاگشيامزآ ياه سالك رد نايوجشناد دننك قيقحت دوخ قيالع دروم.
					3. ثحابم اب يطابترا چيه يهاگشيامزآ ياه سالك ياه تيلاعف دنرادن يميش ياه سالك رد دوجوم.
					4. ييامنهار يارب يفافش نيناوق يهاگشيامزآ ياه سالك دنراد نايوجشناد.
					5. تسا غولش رايسب هاگشيامزآ ،تاشيامزآ ماجنا نامز رد.
					6. يزيچان تصرف نايوجشناد يميش هاگشيامزآ ياه سالك رد دنراد رگيدكي تخانش يارب.
					7. يارب ات دوش يم هتساوخ ام زا ،يميش هاگشيامزآ ياه سالك رد مينك يحارط ارتاشيامزا نامدوخ ،هدش هداد هلاسم لح.
					8. يتاعوضوم اب يميش هاگشيامزآ ياه سالك رد هدش ماجنا ياهراك دنرادن يطابترا مينك يم هعلاطم يميش يروئت سالك رد هك.
					9. و هدوب يمسر ريغ رتشيب يميش هاگشيامزآ ياه سالك تسين مكاح اهنآ رد يصاخنيناوق.
					10. ياه تيلاعف ماجنا يارب نايوجشناد هك يداوم و تازيهجت دشاب يم دوجوم يتحار هب ،دنراد زاين يهاگشيامزآ.

					.دننك يم كمك رگيدكي هب هاگشيامزآ ياه سالك رد نايوجشناد 11.
					ياه هداد نوگانوگ نايوجشناد ،يميش هاگشيامزآ ياه سالك رد 12. .دننك يم يروآ عمج هلاسم كي لح ياربً ار ينوگانوگ
					ماغدا يميش هاگشيامزآ ياه سالك اب يميش يروئت ياه سالك 13. .دنوش يم
					يوريپ يصاخ نيناوق زا ات دوش يم هتساوخ نايوجشناد زا 14. .دننك
					.درادن يدنموربآ و بسانم رهاظ هاگشيامزآ 15.
					رگيدمه يبوخ هب يميش هاگشيامزآ ياه سالك رد نايوجشناد 16. .دنوش يم انشآ مه اب و هتخانش ار
					ياه تيلاعف زا رتارف ات دوش يم هداد هزاجا نايوجشناد هب 17. دنهد ماجنا ار ناشدوخ هاوخلد ياه شيامزآ و هتفر لومعم يهاگشيامزا
					رد هدش هتفگ ياه يروئت زا يشيامزآ ياه تيلاعف يط رد 18. .مينك يم هدافتسا يميش سالك
					مكح يصاخ ينميا لوصا يميش هاگشيامزآ ياه سالك رد 19. .تسامرف
					.دنراد يبسانمان تيعضو يهاگشيامزآ تازيهجت 20.
					كمك يور دنناوت يم يميش هاگشيامزآ ياه سالك رد نايوجشناد 21. .دننك باسح رگيدكي
					تاشيامزآ نايوجشناد ،يميش هاگشيامزآ ياه سالك رد 22. .دنهد يم ماجنا ار ينوگانوگ
					تاعوضوم اب يميش يروئت ساه سالك رد هدش ثحب تاعوضوم 23. .دنتسه تىوافتم الماك يميش هاگشيامزآ ياه سالك رد هدش راك
					هك دراد دوجو يمك نينوق يميش هاگشيامزآ ياه سالك رد 24. .دنتسه اهنآ زا يوريپ هب فظوم نايوجشناد
					ياضف .درادن يبسانم يكيزيف طيارش يميش هاگشيامزآ 25. درس رايسب اه ناتسمز و مرگ اه ناتسبات و هتشاد يا هتفرگ .تسا
					ياه سالك رد يسك اب ناوتب ات دشك يم لوط يدايز ينامز 26. .دش انشآ يميش هاگشيامزآ
					دروم رد هك تسا داتسا نيا يميش هاگشيامزآ ياه سالك رد 27. .دريگ يم ميمصت تاشيامزآ ماجنا هار نيرتهب
					كرد هب ميهد يم ماجنا يميش هاگشيامزآ ياه سالك رد هك يياهراك 28. كمك يميش يروئت ياه سالك رد هدش هتفگ ياه يروئت زا ام رتهب .دنك يم
					ياربً ار ينميا تاكن داتسا تاشيامزآ عورش زا لبق 29. .دهد يم حيضوت نايوجشناد
					ماجنا و ندرك راك ياربً يباذج طيحم يميش هاگشيامزآ 30. .تساه تيلاعف
					اب يبوخ يراكمه نايوجشناد يميش هاگشيامزآ ياه سالك رد 31. .دنراد رگيدكي
					ميمصت تاشيامزآ ندرب شيپ هار نيرتهب دروم رد نايوجشناد 32. .دنريگ يم
					سالك رد هدش هتفگ ياه ثحب و يميش هاگشيامزآ رد راك 33. .دنرادن مه اب يطابترا چيه يميش يروئت
					اب رگيد ياه س الك اب هسياقم رد يميش هاگشيامزآ ياه سالك 34. .دنوش يم تيريدم و لرتنك يرت فافش نيناوق
					يهورگ اي و يدرف راك ياربً يفاك ياضف يميش هاگشيامزآ 35. .دشاب يم ارادً ار

The preferred form of the Persian version of SLEI

اب يرقت هش يمه	ابلاغ	ي هاگ تاقوا	هب تردن	اب يرقت زگره	
					تسياب يميميش هاگشيامزآ ياه سالك رد نايوجشناد .1 دنزادرپب تيلاعف هب مورگ بلاق رد يبوخ هب.
					نيا تسيابيم يهاگشيامزآ ياه سالك رد نايوجشناد .2 دننك قيقحت دوخ قيالع دروم رد ات دنشاب هتشاد ار تصرف.
					چيه تسيابيم يهاگشيامزآ ياه سالك ياه تيلاعف .3 دشاب هتشادن يميش ياه سالك رد دوجوم ثحابم اب يطابترا.
					يفاش نيناوق تسيابيم يهاگشيامزآ ياه سالك .4 دنشاب هتشاد نايوجشناد ييامنهار يارب.
					غولش تسيابيم هاگشيامزآ ،تاشيامزآ ماجنا نامز رد .5 دشاب.
					تسيابيم نايوجشناد يميش هاگشيامزآ ياه سالك رد .6 دنشاب هتشاد رگيدكي تخانش يارب يزيچان تصرف.
					ام زا تسيابيم ،يميش هاگشيامزآ ياه سالك رد .7 يحارط ارتاشيامزا نامدوخ ،هدش هداد لئاسم لح يارب ات دوش هتساوخ كنيم.
					يم يميش هاگشيامزآ ياه سالك رد هدش ماجنا ياهراك .8 مينك يم هعلاطم يميش يروئت سالك رد هك يتاعوضوم اب تسياب دنشاب هتشادن يطابترا.
					ريغ رتشيب تسيابيم يميش هاگشيامزآ ياه سالك .9 دشابن مكاح امنآ رد يصاخ نيناوق و هدوب يمسر.
					تيلاعف ماجنا يارب نايوجشناد هك يداوم و تازيهجت .10 دشاب دوجوم يتحار هب تسيابيم ،دنراد زاين يهاگشيامزآ ياه.
					هب تسيابيم هاگشيامزآ ياه سالك رد نايوجشناد .11 دننك يم كمك رگيدكي.
					نوگانوگ نايوجشناد ،يميش هاگشيامزآ ياه سالك رد .12 دننك يروآ عمج هلاسم كي لح يارب ار ينوگانوگ ياه هداد تسياب يم.
					ياه سالك اب تسيابيم يميش يروئت ياه سالك .13 دنوش ماغدا يميش هاگشيامزآ.
					زا ات دوش يم هتساوخ نايوجشناد زا تسيابيم .14 دننك يوريپ يصاخ نيناوق.
					يدنموربآ و بسانم رهاظ تسيابيم هاگشيامزآ .15 دشاب هتشاد.
					يم يميش هاگشيامزآ ياه سالك رد نايوجشناد .16 دنوش انشآ مه اب و هتخانش ار رگيدمه يبوخ هب تسياب.
					ات دوش يم هداد هزاجا نايوجشناد هب تسيابيم .17 هاوخلد ياه شيامزآ و هتفر لومعم يهاگشيامزا ياه تيلاعف زا رتارف دنهد ماجنا ار ناشدوخ
					يروئت زا تسيابيم يشيامزآ ياه تيلاعف يط رد .18 دوش هدافتسا يميش سالك رد هدش هتفگ ياه..
					لوصا تسيابيم يميش هاگشيامزآ ياه سالك رد .19 دشاب امرف مكح يصاخ ينمي.
					يبسانم تيعضو تسيابيم يهاگشيامزآ تازيهجت .20 دنشاب هتشاد.

					21. يم يميش هاگشيامزآ ياه سالك رد نايوجشناد .دننك باسح رگيدكي كمك يور دنناوتب تسياب
					22. يم نايوجشناد ،يميش هاگشيامزآ ياه سالك رد .دنهد ماجنا ار ينوگانوگ تاشيامزآ تسياب
					23. يم يميش يروئت ساه سالك رد هدش ثحب تاعوضوم الماك يميش هاگشيامزآ ياه سالك رد هدش راك تاعوضوم اب تسياب . .دشاب توافتم
					24. نيناوق تسياب يم يميش هاگشيامزآ ياه سالك رد .دنشاب اهنآ زا يوريپ هب فظوم نايوجشناد هك دشاب هتشاد دوجو
					25. يكيزيف طيارش تسياب يم يميش هاگشيامزآ مرگ اه ناتسبات و هتشادن يا هتفرگ ياضف .دشاب هتشاد يبسانم .دشابن درس رايسب اه ناتسمز و
					26. اب ناوتب ات دشكن لوط يدايز ينامز تسياب يم .دش انشآ يميش هاگشيامزآ ياه سالك رد يسك
					27. رد تسياب يم داتسا يميش هاگشيامزآ ياه سالك رد .دريگب ميمصت تاشيامزآ ماجنا هار نيرتهب دروم
					28. يم ماجنا يميش هاگشيامزآ ياه سالك رد هك يياهراك سالك رد هدش هتفگ ياه يروئت زا ام رتهب كرد هب تسياب يم ميهد .دنك كمك يميش يروئت ياه
					29. تاكن تسياب يم داتسا تاشيامزآ عورش زا لبق .دهد حيضوت نايوجشناد يارب ار ينميا
					30. راك يارب يباذج طيحم تسياب يم يميش هاگشيامزآ .دشاب تيلاعف ماجنا و ندرك
					31. يم نايوجشناد يميش هاگشيامزآ ياه سالك رد .دنشاب هتشاد رگيدكي اب يبوخ يراكمه تسياب
					32. شيپ هار نيرتهب دروم رد تسياب يم نايوجشناد .دنريگب ميمصت تاشيامزآ ندرب
					33. رد هدش هتفگ ياه ثحب و يميش هاگشيامزآ رد راك .دنشاب هتشاد مه اب يطابترا چيه تسياب يم يميش يروئت سالك
					34. ياه س الك اب هسياقم رد يميش هاگشيامزآ ياه سالك .دنوش تيريدم و لرتنك يرت فافش نيناوق اب تسياب يم رگيد
					35. يارب يفاك ياضف تسياب يم يميش هاگشيامزآ .دشاب اراد ار يهورگ اي و يدرف راك

REFERENCES

Aldridge, J.M. & Fraser, B.J. (2008). *Outcomes-focused learning environments: determinants and effects.* Rotterdam: Sense.

Aldridge, J.M., Fraser, B.J.& Huang, T.-C.I. (1999).Investigating classroom environments in Taiwan and Australia with multiple research methods. *J. Educ. Res., 93,* 48–62.

Aldridge, J.M. & Fraser, B.J. (2000). A cross-cultural study of classroom learning environments in Australia and Taiwan.*Learning Environments Res., 3*, 101–134.

Aldridge, J.M., Fraser, B. J. & Sebela, M.P. (2004). Using teacher action research to promote constructivist learning environments in South Africa. *South African J. Educ*., *24*, 245–253.

Aldridge, J.M., Laugksch, R.C. & Fraser, B.J. (2006). School-level environment and outcomes-based education in South Africa. *Learning Environments Research*, 9, 123–147.

Brislin, R.W. (1970). Back translation for cross-cultural research. *J. Cross-Cultural Psychol., 1,* 185–216.

Dorman, J.P. (2001). Association between classroom environment and academic efficacy. *Learning Environments Res*., *4*, 243–257.

Fisher, D.L., Fraser, B.J. & Bassett, J. (1995). Using a classroom environment instrument in an early childhood classroom. *Australian J. Early Childhood*, *20*(3), 10–15.

Fisher, D., Harrison, A., Henderson, D. & Hofstein, A. (1999). Laboratory learning environments and practical tasks in senior secondary science classes. *Res.Sci. Educ., 28*, 353-363.

Fraser, B.J. (1990). *Individualised classroom environment questionnaire*. Melbourne: Australian Council for Educational Research.

Fraser, B.J. (1998a). Science learning environments: assessment, effects and determinants (pp. 527-564). In: Fraser. B.J. & Tobin, K. (Eds.). *International handbook of science education*. Dordrecht: Kluwer.

Fraser, B.J. (1998b). Classroom environment instruments: development, validity and applications. *Learning Environments Research, 1*, 7–33.

Fraser, B.J. (2002). Learning environment research: yesterday, today and tomorrow (pp. 1- 25). In: Goh, S.C. & Khine, M.S. (Eds.). *Studies in educational learning environments: an international perspective*. Singapore: World Scientific.

Fraser, B.J. (2007). Classroom learning environments (pp. 103-124). In: Abell, S.K. & Lederman, N.G. (Eds.). *Handbook of research on science education*. Mahwah: Lawrence Erlbaum.

Fraser, B.J. &Chionh, J.H. (2000). Classroom environment, self-esteem, achievement and attitudes in geography and mathematics in Singapore. *Paper presented at the annual meeting of the American Education Research Association.* New Orleans.

Fraser, B. & McRobbie, C.J. (1995). Science laboratory classroom environments at schools and universities: a cross-national study. *Educ. Res. & Evaluation, 1*, 289-317.

Fraser, B., McRobbie, C.J. & Giddings, G.J. (1993). Development and cross-national validation of a laboratory classroom instrument for senior high school students. *Science Education, 77*, 1-24.

Gunstone, R.F. (1991). Reconstructing theory from practical experience (pp. 67-77). In: Woolnough, B.E. (Ed.). *Practical science*. Milton Keynes: Open University Press.

Hirata, S. & Sako, T. (1998). Perceptions of school environment among Japanese junior high school, nonattendant, and juvenile delinquent students. *Learning Environments Research, 1*, 321–331.

Hofstein, A. (2004). The laboratory in chemistry education: thirty years of experience with developments, implementation, and research. *Chem. Educ. Res. & Pract., 5*, 247-264.

Hofstein, A. & Lunetta, V.N. (2004). The laboratory in science education: foundation for the 21st century. *Science Education, 88*, 28-54.

Hofstein, A., Gluzman, R., Ben-Zvi, R. & Samuel, D. (1979). Classroom learning environment and student attitudes towards chemistry. *Studies Educ. Evaluation, 5*, 231–236.

Hofstein, A., Cohen, I. & Lazarowitz, R. (1996).The learning environment of high school students in chemistry and biology laboratories. *Res.Sci. & Technol. Educ., 14*, 103-115.

Khoo, H.S. & Fraser, B J. (2008).Using classroom psychosocial environment in the evaluation of adult computer application courses in Singapore. *Technology. Pedagogy & Education, 17*, 67–81.

Kim, H.B., Fisher, D.L. & Fraser, B.J. (2000). Classroom environment and teacher interpersonal behaviour in secondary science classes in Korea. *Evaluation & Research in Education, 14*, 3–22.

Koul, R.B. & Fisher, D.L. (2005). Cultural background and students' perceptions of science classroom learning environment and teacher interpersonal behaviour in Jammu, India. *Learning Environments Research, 8*, 195–211.

Lee, S.U., Fraser, B.J. & Fisher, D.L. (2003). Teacher-student interactions in Korean high school science classrooms. *Intern. J. Sci. & Math. Educ., 1,* 67–85.

Lunetta, V.N. (1998). The school science laboratory: historical perspectives and context for contemporary teaching (pp. 249-264). In: Fraser, B.&Tobin, K. (Eds.). *International handbook of science education*. Dordrecht: Kluwer.

Maor, D. & Fraser, B.J. (1996). Use of classroom environment perceptions in evaluating inquiry-based computer-assisted learning. *Intern. J. Sci. Educ., 18*, 401–421.

McRobbie, C.J. & Fraser, B.J. (1993). Associations between student outcomes and psychosocial science environment. *J. Educ. Res., 87*, 78–85.

McRobbie, C.J., Roth, W.M. & Lucus, K.B. (1997). Multiple learning environments in a physics classroom. *Intern. J. Educ. Res., 27,* 333-342.

Moos, R.H. (1968).The assessment of the social climates of correlational institutions. *J. Res. Crime & Delinquency, 5*, 174-188.

Moos, R.H. & Houts, P.S. (1968). The assessment of social atmospheres of psychiatric wards. *J. Abnormal Psychol., 73*, 595-604.

Pallant, J. (2005). *SPSS survival manual: a step by step guide to data analysis using SPSS for Windows (Version 12)*. Allen & Unwin.

Puacharearn, P. (2004). The effectiveness of constructivist teaching on improving learning environments in Thai secondary school science classrooms. *PhD Thesis*. Perth: Curtin University of Technology.

Riah, H. & Fraser, B. J. (1998). Chemistry learning environment and its association with students'achievement in chemistry. *Paper presented at the annual meeting of the American Educational Research Association.* San Diego.

Scott, R. & Fisher, D. (2004).Development, validation and application of a Malay translation of an elementary version of the questionnaire on teacher interaction. *Res. Sci. Educ., 34*, 173–194.

Soerjaningsih, W., Fraser, B.J. & Aldridge, J.M. (2001). Learning environment, teacher-student interpersonal behaviour and achievement among university students in Indonesia. *Paper presented at the annual meeting of the Australian Association for Research in Education*. Fremantle.

Tabachnick, B.G. & Fidell, L.S. (2001). *Using multivariate statistics*. *New York:* Harper Collins.

Terwel, J., Brekelmans, M., Wubbels, T. & van den Eeden, P. (1994). Gender differences in perceptions of the learning environment in physics and mathematics education (pp. 39-51). In: Fisher, D. (Ed.). *The study of learning environments*: *vol. 8*. Perth: Curtin University of Technology.

Trickett, A.G. & Moos, R.H. (1973).Social environmnents of junior and high school classrooms. *J. Educ. Psychol., 65,* 93-102.

Walberg, H.J. & Anderson, G.J. (1968). Classroom climate and individual learning. *J. Educ. Psychol., 5*9, 414–419.
Wolf, S.J. & Fraser, B.J. (2008). Learning environment, attitudes and achievement among middle-school science students using inquiry-based laboratory activities. *Res. Sci. Educ., 38*, 321–341.
Wong, A.L.F., Young, D.J. & Fraser, B.J. (1997). A multilevel analysis of learning environments and student attitudes. *Educ. Psychol., 17*, 449–468.
Wubbels, T. & Brekelmans, M. (1997). A comparison of student perceptions of Dutch physics teachers' interpersonal behavior and their educational opinions in 1984 and 1993. *J. Res. Sci. Teach., 34*, 447–466.
Wubbels, T., Levy, J. & Brekelmans, M. (1997). Paying attention to relationships. *Educational Leadership, 54*(7), 82–86.
Wubbels, T. & Brekelmans, M. (1998). The teacher factor in the social climate of the classroom (pp. 564-580). In: Fraser, B.J.& Tobin, K.G. (Eds.). *International handbook of science education*. Dordrecht: Kluwer.
Wubbels, T.& Brekelmans, M. (2006). Two decades of research on teacher-student relationships in class. *Intern. J. Educ. Res., 43*, 6–24.
Yang, J., Huang, I.T. & Aldridge, J. (2002). Investigating factors that prevent science teachers from creating positive learning environments in Taiwan (pp. 217-234). In: Goh, S.C. & Khine. M.S. (Eds.). *Studies in educational learning environments: an international perspective*. Singapore: WorldScientific.
Yarrow, A., Millwater, J. & Fraser, B.J. (1997). Improving university and primary school classroom environments through preservice teachers' action research. *Intern. J. Pract. Experience Professional Educ., 1,* 68–93.

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