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LEARNING ENVIRONMENT OF UNIVERSITY CHEMISTRY CLASSROOMS IN IRAN

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Abstract. In order to study the learning environment of university chemistry classrooms in Iran, Constructivist Learning Environment Survey (CLES) was carefully translated into Persian and administered to 415 (Male =204 and Female=211) Iranian university students. Data analyses attested to the sound factorial validity and internal consistency reliability of the Persian version of CLES. Comparison of Iranian university students' scores on actual and preferred forms of the questionnaire revealed that students were not satisfied and preferred a more positive chemistry classroom environment on all scales. Favoring a constructivist perspective, this study proposes some measures that could be taken to improve university chemistry classrooms environments. The results will be of significance for chemistry educators to create more constructivist, creative, critical and democratic chemistry classrooms environments. The work is distinctive since it is the first learning environment study delving through chemistry classrooms in Iran.

Keywords: learning environments research, Constructivist Learning Environment Survey (CLES), Iranian chemistry classrooms, satisfaction

Introduction

The field of learning environments research has undergone remarkable growth, diversification and internationalization during the past 30 years (Fraser, 1998). During these years, the study of classroom environments has received increased attention by researchers, educators and school administrators (Dorman et al., 2006). In spite of internationalization of learning environment studies and vast arrays of research in different learning environments, few studies could be located that report some explorations regarding Iranian students' perceptions of their learning environments. Students' perceptions of their classroom learning environments can significantly help us to assess the efficiency of the learning and teaching processes in those environments.

This study, after validating a Persian version of the Constructivist Learning Environment Survey (CLES), tries to delve into Iranian university students' satisfaction with their chemistry classroom learning environments. It also tries to spot the chemistry classrooms environment dimensions that lead to Iranian university students' dissatisfaction and it aims to propose some measures that could be taken to improve these classroom learning environments. The work is unique since it is the first learning environment study in university chemistry classrooms in Iran. It is also the first one that tries to assess university chemistry classroom environments in Iran from a constructivist perspective.

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. Walberg & Anderson (1968) developed the Learning Environment Inventory (LEI). Moos (Moos, 1968; Moos &Houts, 1968) developed a number of social climate scales, including those for use in correctional institutions and psychiatric hospitals.

Interest in the concept of learning environments then spread. Numerous research studies have revealed 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). Fraser (1998) 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 meaningful learning.

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 research studies which explore learning environments at various grade levels (primary, secondary, tertiary) and in a variety of classrooms such as 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. Soerjaningsihet al.[1)] and Maor & Fraser (1996) provide insightful ideas about the nature and promotion of computer classrooms environments. Among the rest, Moss & Fraser[2)] and 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[3)]). Psychosocial environments of physics classrooms have also been the subject of studies such as McRobbie et al. (1997) and Terwel et al. (1994). Chemistry classroom environments have also been the target of exploration in different studies (e.g., Hofstein et al., 1996; Hofstein et al., 1979; McRobbie & Fraser, 1993; Wong et al., 1997; Riah & Fraser, 1998).

This study is among those ones that report evaluation, exploration or promotion of chemistry classroom 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 (e.g., Wubbels & Brekelmans, 2006), and to Australia, where it was carried forward by Barry Fraser (1998; 2007). Learning environment research has since spread further afield to Asia (Fraser, 2002) and South Africa (Aldridge et al., 2006).

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 1998).

In Asia, the study of learning environments has been undertaken in Brunei (Scott & Fisher 2004), Indonesia (Margianti, Aldridge, & Fraser, 2004; Soerjaningsih et al.,[1)] Taiwan (Aldridge et al., 1999), Singapore (Khoo & Fraser, 2008; Wonget al., 1997), Japan (Hirata & Sako, 1998), India (Koul & Fisher, 2005), Korea (Kim et al., 2000; Lee et al., 2003) and Thailand (Puacharearn, 2004). It should be noted that this study is the first learning environment research concerning chemistry classroom settings in Iran.

Studies on chemistry classrooms environments

In this part, some of the studies exploring chemistry classrooms environments are discussed. McRobbie & Thomas (2001) reports an attempt to change the learning environment in a year 12 chemistry classroom and documents changes in participants' perceptions of their learning environments and the corresponding changes in a teacher's and her students' perceptions of their reasoning and understanding that such changes facilitated. A community of learners in which students and teachers began to understand the processes and the value of reasoning in terms of theories and evidence was developed as a result of the involvement of the researchers with the teacher and her class of students. Quek et al. (1998) cross-validated the Questionnaire on Teacher Interaction(QTI) among 497 tenth grade chemistry students, reported some sex and stream (gifted vs. express) differences in perceptions of teacher-student interaction, and established associations between QTI scales and student enjoyment of chemistry lessons. Riah & Fraser[4)] investigated how the introduction of new curricula has influenced learning environments in high school chemistry classes in Brunei. Riah & Fraser (1997) used a modified version of the WIHIC in Brunei, and reported 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 scaleswere positively associated with students' attitudes. In another study, Hofstein & Lazarowitz (1986) compared the actual and preferred classroom learning environment in biology and chemistry as perceived by high school students. 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 & Burden, 1998), they found that there was a significant difference between students' scores on actual and preferred form.

Constructivism

Constructivism is a theory about knowledge and learning and refers to the epistemological belief that people construct their own understanding of reality (Duffy & Cunningham, 1996; Fosnot, 1996). This theory defines knowledge as temporary, developmental, socially and culturally mediated, and thus, non-objective (Reagon, 1999). Learning from this perspective is understood as a self-regulated process of resolving inner cognitive conflicts that often become apparent through concrete experience, collaborative discourse and reflection (Fosnot, 1993). Constructing understandings of one's world is an active, mind-engaging process (Sigel & Cocking 1977; Von Glasersfeld, 1981). While it is true that, as learners, we all take in some information passively, the constructivist perspective proposes that even this information must be mentally acted upon in order to have meaning for the learner (Brooks & Brooks, 1999).

Constructivists state that individuals make sense of their worlds by synthesizing new experiences into what they have come to understand in the past. Frequently, we face an object, an idea, a phenomenon, or a relationship that does not completely make sense to us. When confronted with such initially discordant data or perceptions, we either interpret what we see to conform to our present set of rules for explaining and ordering our world, or we generate a new set of rules that better accounts for what we perceive to be occurring (Brooks & Brooks, 1999). For constructivists, learning is not discovering more, but interpreting through a different scheme or structure.

Constructivism stands in contrast to the deeply rooted ways of teaching that dominate our university chemistry classrooms. In our chemistry classrooms, learning is assumed as a process that includes students repeating, or miming, newly presented information in informal or formal tests. Constructivist teaching practices, on the other hand, help learners "to internalize and reshape, or transform, new information" (Brooks & Brooks, 1999). Transformation occurs through the creation of new understandings that are the results of the emergence of new cognitive structures (Gardner, 1991).

In objectivist environments, like our university chemistry classrooms, students are asked to express their learning through multiple-choice or short-answer tests. In such environments, grades are the means for documenting student' learning. But constructivist approach emphasizes deep understanding and the criterion for learning is not what students can repeat but what they can generate, demonstrate, and exhibit (Brooks &

Brooks, 1999). In addition, objectivist instructions in our chemistry classrooms often lead students to believe they are not interested in chemistry. The constructivist paradigm holds that this lack of interest is a function of the ways in which students are taught not a function of the subject areas.

Constructivist learning environments provide learners with authentic or complex problems or projects. Learning-support strategies such as modeling, coaching, and scaffolding are indispensable practices for a constructivist teacher (Jonassen et al., 2003). Constructivist teachers create environments which are student-centered and learner-controlled, emphasizing student responsibility and initiative in determining learning goals and regulating their performance toward those goals, not just determining the path through a prescribed set of learning activities (Marra, 2004).

While objectivist approach, at best, increases learners' context-reduced and inert knowledge which is useful just on test occasions, social constructivism enhances learners' abilities of problem-solving, critical reflection, and thoughtful application of and contribution to knowledge based on a deep understanding of what is happening in the social context.

In a constructivist classroom, problems are posed to be relevant to students and learning is structured around primary concepts. Students' points of view are sought and valued and the curriculum is adopted so that students' suppositions and interests are addressed. In addition, students' learning is assessed in the context of teaching.

Advocates of this view mention the following as benefits of constructivist learning environments: (i) students learn more, and enjoy learning more when they are actively involved, rather than passive listeners; (ii) education works best when it concentrates on thinking and understanding, rather than on rote memorization -constructivism concentrates on learning how to think and understand; (iii) constructivist learning is transferable -in constructivist classrooms, students create organizing principles that they can take with them to other learning settings; (iv) constructivism gives students ownership of what they learn, since learning is based on students' questions and explorations, and often the students have a hand in designing the assessments as well; constructivist assessment engages the students' initiatives and personal investments in their journals, research reports, physical models, and artistic representations -engaging the creative instincts develops students' abilities to express knowledge through a variety of ways; the students are also more likely to retain and transfer the new knowledge to real life; (v) by grounding learning activities in an authentic, real-world context, constructivism stimulates and engages students- students in constructivist classrooms learn to question things and to apply their natural curiosity to the world; (vi) constructivism promotes social and communication skills by creating a classroom environment that emphasizes collaboration and exchange of ideas – students must learn how to articulate their ideas clearly as well as to collaborate on tasks effectively by sharing in group projects;students must therefore exchange ideas and so must learn to "negotiate" with others and to evaluate their contributions in a socially acceptable manner – this is essential to success in the real world, since they will always be exposed to a variety of experiences in which they will have to cooperate and navigate among the ideas of others.

About CLES

The CLES was developed to assist researchers and teachers to assess the degree to which a particular classroom's environment is consistent with a constructivist epistemology, and to assist teachers to reflect on their epistemological assumptions and reshape their teaching practice (Fraser, 2002(.

The first version of the CLES[5)] consisted of 28 items included in four scales (viz. Autonomy, Prior Knowledge, Negotiation, and Student Centeredness). Later it was revised and another scale was added as a response to the lack of any critical theory perspective in this instrument. The result was a 30-item questionnaire with five scales: Personal Relevance, Uncertainty, Critical Voice, Shared Control, and Student Negotiation (Taylor et al., 1997). Description of scales is provided in Table 1. Each item can be responded on a five-point Likert scale ranging from Almost Never to Almost Always. There are versions for both science and for mathematics as well as for teachers and for students in actual and preferred forms.

Table 1. Scale description for each dimension of the CLES

Scale	Scale Description
Personal relevance	Extent to which school activities and knowledge is relevant to students' everyday out-of-school experiences
Uncertainty	Extent to which opportunities are provided for students to experience that knowledge is evolving and culturally and socially determined
Critical voice	Extent to which students feel that it is legitimate and beneficial to question the teachers' pedagogical plans and methods
Shared control	Extent to which students have opportunities to explain and justify their ideas, and to test the viability of their own and other students' ideas
Student negotiation	Extent to which students share with the teacher control for the design and management of learning activities, assessment criteria, and social norms of the classroom.

The CLES has been used in a variety of studies which evaluate psychosocial aspects of different classrooms in different educational settings[6] (*cf.* Nix et al., 2005; Johnson & McClure, 2004; Dorman,2001; Harwell et al., 2001; Aldridge et al., 2000).

In addition, some studies have confirmed the internal consistency reliability and factorial validity of the CLES. For example, in Western Australia, Taylor et al. (1997) established the factorial validity and reliability of the CLES with a sample of 494 13-year-old students in 41 science classes in 13 schools. Additionally, a sample of 1081 science students in 50 classes was studied by Aldridge et al. (2000) for cross-validating the CLES in Australia. The CLES also has been validated for use in Korea[7] (Kim et al., 1999) and Taiwan (Aldridge et al., 2000). Kim et al. (1999) translated the CLES into the Korean language and administered it to 1083 science students in 24 classes in 12 schools. The original five-factor structure was replicated for the Korean-language version of both an actual and a preferred form of the CLES. Similarly, Lee (2001) replicated the five-factor structure of a Korean-language version of the CLES among 440 Grade 10 and 11 science students in 13 classes. In addition, the CLES has been translated into Chinese for use in Taiwan (Aldridge et al., 2000). In this cross-national study, the original English version was administered to 1081 science students in 50 classes in Australia, while the new Chinese version was administered to 1879 science students in 50 classes in Taiwan. The same five-factor structure emerged for the CLES in the two countries and scale reliabilities were similar.

Development of the Persian version of CLES

A contextual, rather than textual, translation of the original version of the CLES was undertaken. Since the study is just concerned about chemistry classrooms, the word “science” in the original CLES was translated into “chemistry” in the Persian version.

Because 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 CLES has five scales with six 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 CLES was then distributed among 415 (M=204 and F=211) Iranian university students in 17chemistry classes in five universities. Among these 17 classes, five were related to Islamic Azad University of Arsanjan, four to Islamic Azad University of Marvdasht, four to Shiraz University, two to Islamic Azad University of Abadeh, and two to University of Kashan. With regard to age, most of the participants were from

19 to 23 (N=378). With regard to years of study and major, students were mainly freshmen and sophomores and were studying different fields including civil engineering, mechanical engineering, biochemistry, physics, biology, genetics, nuclear engineering, and chemistry.

The number of students in each class ranged from 27 to 44.

In general, students in Islamic Azad University of Arsanjan formed 26.5% (N=110), Islamic Azad University of Marvdasht 23.1 % (N=96), University of Kashan 20.24 % (84), Shiraz University 19.75 % (N=82), and Islamic Azad University of Abadeh 10.36% (N=43) of the whole sample.

Field testing and validation of the Persian version of CLES

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 CLES.

Before conducting factor analysis, the strength of the inter-correlations among the items should be investigated (Pallant, 2005). If the items of the questionnaire are measuring the same underlying trait they shall correlate with each other. For inspecting the inter-correlation among the items, the correlation matrices for actual and preferred forms of the Persian version of CLES were provided. Tabachnick & Fidell (2001) and Pallant (2001) recommend an inspection of the correlation matrix for evidence of coefficients greater than 0.3. Few correlations above this level may make factor analysis inappropriate. There is no exact criterion concerning the number of coefficients above 0.3 but the number of coefficients greater than 0.3 was not limited in the correlation matrices provided for two forms of the Persian version of CLES.

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).

The KMO index was higher than 0.6 (.786 and .856 for actual and preferred forms respectively) and the result of the Bartlett's test of sphericity was significant ($p<0.05$). These two measures also attested to the factorability of the data for factor analysis.

Factor analysis

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

Table 2. Factor loadings from confirmatory factor analysis (actual form)

ITEMS	Factor Loadings				
	PR	UN	CV	SC	SN
A1	.725				
A2	.668				
A3	.528				
A4	.653				
A5	.661				
A6	.540				
A7					
A8		.417			
A9		.622			
A10		.495			
A11		.524			
A12		.674			
A13			.544		
A14			.786		
A15			.705		
A16			.732		
A17			.665		
A18			.726		
A19				.814	
A20				.703	
A21				.789	
A22				.715	
A23				.750	
A24				.676	
A25					.600
A26					.668
A27					.654
A28					.743
A29					.715
A30					.764

Note. PR = Personal Relevance; UN = Uncertainty; CV = Critical Voice; SC = Shared Control; SN = Student Negotiation.

Table 3. Factor loadings from confirmatory factor analysis (preferred form)

ITEMS	Factor Loading				
	PR	UN	CV	SC	SN
P1	.777				
P2	.575				
P3	.744				
P4	.783				
P5	.707				
P6	.438				
P7		.517			
P8		.717			
P9		.744			
P10		.580			
P11		.749			
P12		.533			
P13			.750		
P14			.778		
P15			.827		
P16			.814		
P17			.716		
P18			.681		
P19				.682	
P20				.736	
P21				.747	
P22				.725	
P23				.654	
P24				.522	
P25					.483
P26					.631
P27					.680
P28					.775
P29					.759
P30					.829

Note. PR = Personal Relevance; UN = Uncertainty; CV = Critical Voice; SC = Shared Control; SN = Student Negotiation.

The results of factor analyses for actual and preferred forms are provided in Table 2 and Table 3, respectively. Loadings of less than 0.40, 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. Overall, this study provides support for the a priori five-factor structure of the final version of the Persian version of CLES; all items have a factor loading of at least 0.4 on their a priori scale. It is acceptable to maintain all 30 items of five scales in this questionnaire for further analysis.

Internal consistency reliability of the Persian version of CLES

Table 4 reports the internal consistency (alpha reliability coefficient) for the 30-item Persian version of CLES, with separate reports for actual and preferred forms. Table 4 suggests that each scale of the Persian version of CLES has acceptable internal consistency in all cases.

Table 4. 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**
Personal Relevance	.72	.78
Uncertainty	.76	.74
Critical Voice	.83	.88
Shared Control	.86	.86
Student Negotiation	.80	.85

Differences between actual and preferred learning environment

Data collected using the Persian version of CLES 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 Personal Relevance, Uncertainty, Critical Voice, Shared Control and Student Negotiation.

Again, 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. Five groups of scores for each form of the questionnaire were provided for all participants. In other words, scores on Personal Relevance, Uncertainty, Critical Voice, Shared Control and Student Negotiation dimensions for all students for each form were provided. The score for each scale was the mean of the each participant's answer on that scale.

Table 5. 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	PR(Actual) – PR(Preferred)	-.72	1.02	.05	-4.38	-.62	-14.2	414	**.000**
Pair 2	UN(Actual) – UN(Preferred)	-.66	.80	.03	-4.14	-.58	-16.6	414	**.000**
Pair 3	CV(Actual) – CV(Preferred)	-.88	1.19	.05	-5.47	-.77	-15.1	414	**.000**
Pair 4	SC(Actual) – SC(Preferred)	-1.27	1.14	.05	-7.19	-1.1	-22.8	414	**.000**
Pair 5	SN(Actual) – SN(Preferred)	-.79	.93	.04	-4.55	-.70	-17.4	414	**.000**

Note. PR = Personal Relevance; UN = Uncertainty; CV = Critical Voice; SC = Shared Control; SN = Student Negotiation.

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 5. As it is clear, there are significant differences ($p<0.05$) between scores on Personal Relevance, Uncertainty, Critical Voice, Shared Control and Student Negotiation 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 actually present in terms of the five dimensions of Personal Relevance, Uncertainty, Critical Voice, Shared Control and Student Negotiation. 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).

The measures that could be taken

This study introduces social constructivism as an effective solution improving our chemistry classrooms environments.

The results of this study can be of interest and significance for those educators searching for new ways of looking at chemistry 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.

Our university chemistry classroom environments 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). We should redesign our classrooms 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). Our chemistry 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). More suggestions for Iranian chemistry teachers aspiring to become constructivist teachers can be provided as follows (mainly borrowed from Brooks and Brooks (1999)): (i) Constructivist teachers encourage and accept student autonomy and initiative; (ii) Constructivist teachers use raw data and primary sources, along with manipulative, interactive, and physical materials; (iii) When framing tasks, constructivist teachers use cognitive terminology such as "classify," "analyze," "predict," and "create."; (iv) Constructivist teachers allow student responses to drive lessons, shift instructional strategies, and alter content; (v) Constructivist teachers inquire about students' understandings of concepts before sharing their own understandings of those concepts; (vi) Constructivist teachers encourage students to engage in dialogue, both with the teacher and with one another; (vii) Constructivist teachers encourage student inquiry by asking thoughtful, open-ended questions and encouraging students to ask questions of each other; (viii) Constructivist teachers seek elaboration of students' initial responses; (ix) Constructivist teachers engage students in experiences that might engender contradictions to their initial hypotheses and then encourage discussion; (x) Constructivist teachers allow wait time after posing questions; (xi) Constructivist teachers provide time for students to construct relationships and create metaphors.

Conclusion

This study, for the first time, tried to investigate university chemistry classroom environments in Iran. A Persian version of CLES was validated and used to assess Iranian university students' perceptions of their chemistry classroom environments from a constructivist perspective. 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 &Burden, 1998), the results showed that chemistry classroom environments in Iran are not in line with our university students' interests and preferences. Suggestions were also made to help Iranian chemistry practitioners improve these classrooms environments.

The Persian version of the CLES provided in Appendix A will both motivate and facilitate the growth of learning environment research in chemistry 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).

Our university students' views on chemistry classrooms environments are of value as the windows to the world of classrooms. They are not satisfied with their chemistry classrooms environments and changes seem necessary. Here constructivism is introduced as an effective solution decreasing or even eliminating lots of defects in Iranian university chemistry classrooms.

Appendix: The actual and preferred forms of the Persian version of CLES

Note: Items 1 to 6 are related to Personal Relevance scale, items 7 to 12 are related to Uncertaintyscale, items 13 to 18 are related to Critical Voice scale, items 18 to 24 are related to Shared Control scale and items 25 to 30 are related to Student Negotiation scale.

The actual form of the Persian version of CLES

ابيرقت هشيمه	ابلاغ	يهاگ تاقوا	هب تردن	ابيرقت زگره	اه هنيزگ	هرامش
					يم سالك زا جراخ يايند دروم رد يدايز تاكن مزومآ.	1.1
					هك دوش يم زاغآ يليا‌سم اب ديدج تاكن يريگداي دنراد راك و رس سالك زا جراخ يايند اب.	.2
					يشخب دناوت يم هنوگچ يميش هك مريگ يم داي دشاب مسرد سالك زا جراخ يايند زا.	.3
					اديپ سرد سالك زا جراخ يايند زا يرتهب كرد مي كنم.	.4

					سالك زا جراخ يايند دروم رد يبلاج ييامزيچ .مريگ يم داي سرد	.5
					اب يطابترا چيه مريگ يم داي هك ييامزيچ .درادن سرد سالك زا جراخ يايند	.6
					يلماك خساپ دناوت يمن يميش هك مريگ يم داي .دهد هيارا تالاوس همه ياارب	.7
					رييغت نامز رذگ رد يميش هك مريگ يم داي .تسا هدرك	.8
					ياه شزرا و دياقع زا يميش هك مريگ يم داي .تسا هتفرگ ريثات دارفا	.9
					رد هدش حرطم يميش نوگانوگ تايرظن زا .منك يم اديپ يهاگآ نوگانوگ ياه گنهرف	.10
					هتشذگ يميش اب نردم يميش هك مريگ يم داي .دراد توافت	.11
					هارمه تايرظن قلخ اب يميش هك مريگ يم داي .تسا	.12
					نيا مروبجم ارچ" مسربپ داتسا زا مناوت يم "؟مزومايب ار بلاطم	.13
					.منك داقتنا دوجوم سيردت شور زا هك مناوت يم	.14
					هدننك چيگ يشزومآ ياه تيلاعف زا هك مناوت يم .منك تياكش	.15
					نم يريگداي زا عنام هك يزيچ ره زا هك مناوت يم .منك تياكش دوش يم	.16
					.منك حرطم ار متارظن و دياقع مناوت يم	.17
					.منك عافد دوخ قح زا مناوت يم	.18
					رارق هك ييامزيچ ياارب ات منك يم كمك داتسا هب .دنك يزير همانرب مريگب داي تسا	.19
					دريگب ميمصت هكنيا ات منك يم كمك داتسا هب .ما هتخومآ ار بلاطم بوخ ردقچ هك	.20
					دريگب ميمصت هكنيا ات منك يم كمك داتسا هب .تسا رتهب نم ياارب اه تيلاعف مادك	.21
					هچ دريگب ميمصت ات منك يم كمك داتسا هب .مراد مزال تقو اه تيلاعف يريگداي ياارب تدم	.22
					مادك دريگب ميمصت ات منك يم كمك داتسا هب .مهد ماجنا ار اه تيلاعف	.23
					يبايزرا ارم يريگداي ات منك يم كمك داتسا هب .دنك	.24
					نايوجشناد رگيد اب ات مراد ار تصرف نيا .منك وگتفگ	.25
					رگيد اب ليامسم لح يگنوگچ دروم رد .منك يم تبحص نايوجشناد	.26
					نايوجشناد رگيد ياارب ار بلاطم زا مدوخ كرد .مهد يم حيضوت	.27

					ار ناشراكفا هك مهاوخ يم ناﻳوجشناد رگيد زا دنهد حيضوت ميارب.	.28
					ار متارظن ات دنهاوخ يم نم زا ناﻳوجشناد رگيد منك حرطم.	.29
					ناﻳب نم يارب ار ناشتارظن ناﻳوجشناد رگيد دننك يم.	.30

The proffered form of the Persian version of CLES

ابيرقت هشيمه	ابلاغ	يهاگ تاقوا	هب تردن	ابيرقت زگره	اه هنيزگ	هرامش
					سالك زا جراخ يايند دروم رد يدايز تاكن دياب مزومايب.	1.1
					دوش زاغآ يليامسم اب دياب ديدج تاكن يريگداي دنراد راك و رس سالك زا جراخ يايند اب هك.	.2
					دناوت يم هنوگچ يميش هك مريگب داي دياب دشاب مسرد سالك زا جراخ يايند زا يشخب.	.3
					سرد سالك زا جراخ يايند زا يرتهب كرد دياب منك يم اديپ.	.4
					زا جراخ يايند دروم رد يبلاج ييامزيچ دياب مريگب داي سرد سالك.	.5
					يطابترا چيه ديابن مريگ يم داي هك ييامزيچ دشاب هتشاد سرد سالك زا جراخ يايند اب.	.6
					خساپ دناوت يمن يميش هك مريگب داي دياب دهد هيارا تالاوس ممه ياربب يلماك.	.7
					رييغت نامز رذگ رد يميش هك مريگب داي دياب تسا هدرك.	.8
					ياه شزرا و دياقع زا يميش هك مريگب داي دياب تسا هتفرگ ريثات دارفا.	.9
					رد هدش حرطم يميش نوگانوگ تايرظن زا دياب منك اديپ يهاگآ نوگانوگ ياه گنهرف.	.10
					يميش اب نردم يميش هك مريگب داي دياب دراد توافت هتشذگ.	.11
					هارمه تايرظن قلخ اب يميش هك مريگب داي دياب تسا.	.12
					نيا مروبجم ارچ" مسرپب داتسا زا مناوتب دياب "؟مزوماياب ار بلاطم.	.13
					داقتنا دوجوم سيردت شور زا هك مناوتب دياب منك.	.14
					چيگ يشزومآ ياه تيلاعف زا هك مناوتب دياب منك تياكش هدننك.	.15
					يريگداي زا عنام هك يزيچ ره زا هك مناوتب دياب منك تياكش دوش يم نم.	.16

					منك. حرطم ار متارظن و دياقع مناوتب دياب	.17
					منك. عافد دوخ قح زا مناوتب دياب	.18
					هك ييامزيچ يارب ات منك كمك داتسا هب دياب دنك. يزير همانرب مريگب داي تسا رارق	.19
					ميمصت هكنيا ات منك كمك داتسا هب دياب ما. هتخومآ ار بلاطم بوخ ردقچ هك دريگب	.20
					ميمصت هكنيا ات منك كمك داتسا هب دياب تسا. رتهب نم يارب اه تيلاعف مادك دريگب	.21
					هچ دريگب ميمصت ات منك كمك داتسا هب دياب مراد. مزال تقو اه تيلاعف يريگداي يارب تدم	.22
					مادك دريگب ميمصت ات منك كمك داتسا هب دياب مهد. ماجنا ار اه تيلاعف	.23
					ارم يريگداي ات منك كمك داتسا هب دياب دنك. يبايزرا	.24
					رگيد اب ات مشاب هتشاد ار تصرف نيا دياب منك. وگتفگ نايوجشناد	.25
					رگيد اب لياسم لح يگنوگچ دروم رد دياب منك. تبحص نايوجشناد	.26
					رگيد يارب ار بلاطم زا مدوخ كرد دياب مهد. حيضوت نايوجشناد	.27
					ناشراكفا هك مهاوخب نايوجشناد رگيد زا دياب دنهد. حيضوت ميارب ار	.28
					متارظن ات دنهاوخب نم زا نايوجشناد رگيد دياب منك. حرطم ار	.29
					نم يارب ار ناشتارظن دياب نايوجشناد رگيد دننك. نايب	.30

NOTES

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