Assessment the Environment of the Chemistry Laboratories at Huazhong Normal University (HZNU) in China and Jordanian University (JU) in Jordan as Perceived by Students

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Abstract: It has been found through significant literature that there have been an increasing number of classroom learning environment research studies employing student perceptual data over the past 30 years however rarely has there been a classroom learning environment study in chemistry class in china and Jordan, so this study is very important to compare between the environment of the chemistry laboratories in china and Jordan, to compare the perceptions of learning environments by males and females in the chemistry laboratories at HZNU and JU by using the Science Laboratory Environment Inventory (SLEI). The SLEI have 5 scales for assessing student cohesiveness, open-endedness, Integration, Rule clarity and material environment. The sample consisted of 311 males and 285 female. According to the study results significant difference were found between the study samples refer to the gender, experience and country.

Key words: Assessment, chemistry laboratory, student perceive

INTRODUCTION

Classroom learning environments have been studied intensively in the last decade in order to find out their relationships to teaching strategies and the social relations between teachers-students, students-students and students subject matters during the instruction process. This effort was demonstrated in several published reviews (Anderson and Walberg, 1974; Fraser, 1981; Chavez, 1984; Byrne *et al.*, 1986) and meta-analyses (Haertel *et al.*, 1981; Fraser *et al.*, 1992). Although, a vast amount of information about learning environments was gathered from research, only in recent years has there been a movement towards using this information to suggest environmental change in the science classroom (Hofstein and Lazarowitz, 1986). In recent years actual and preferred forms of learning environment measures have been used to improve the educational effectiveness of instructional techniques as well as to improve students' achievement, attitude and interest in science (Fraser and Fisher, 1983). The preferred forms are concerned with goals and value orientation and measure perceptions of the laboratory or classroom environment ideally liked or preferred.

Purpose of the study: The study aimed to investigate gender and university difference in classroom environment perceptions using actual and preferred forms of the SLEI at HZNU and JU, to development the assessment of chemistry laboratories at HZNU and JU by using the Science Laboratory Environment Inventory (SLEI), to compare the perceptions of the laboratory learning environment of HZNU students and JU student, to compare the perceptions of learning environments by Males and Females in the chemistry laboratories.

MATERIALS AND METHODS

Sample: The sample consisted of 311 male and 285 female chemistry students distributed on HZNU (137 male and 175 female), JU (311 male and 285 female) distributed on four years of study.

Instrument of study: The chemistry laboratory classroom environment perceptions of the students were measured, using a modified version of the Science Laboratory Environment Inventory (SLEI) designed by Fraser *et al.* (1993). This modified version was renamed Chemistry Laboratory Environment Inventory (CLEI) in the present study.

The SLEI comes in two versions-the actual and the preferred-just like other learning environment instruments. Hence, not only are the students' perceptions of their actual learning environment assessed, but also the students' perceptions of their ideal (preferred) learning environment are measured.

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Furthermore, a noteworthy feature of the SLEI is that it comes in two forms-the class form and the personal form. The class form assesses the students' perceptions of the class as a whole, while the personal form involves assessing the student's perception of his/her own role in the laboratory class. It is hoped that the development of the personal form, the first of its kind for a classroom environment instrument, will allow for "more meaningful and sensitive investigations of the sub environments existing within a class for different subgroups of students, as well as for constructing more meaningful case studies of individual students (Fraser *et al.*, 1995).

In the present study, the chemistry laboratory environment as perceived by the students was measured using the actual and preferred versions of the Personal form of the Science Laboratory Environment Inventory (SLEI) designed by Fraser *et al.* (1995). The personal form was chosen instead of the class form because it was felt that the Personal version would be more sensitive in assessing the differences between subgroups within a class (males and females) (Fraser and Tobin, 1991) which was one of the areas being investigated in this study.

The modified instrument was called the Chemistry Laboratory Environment Inventory (CLEI) and the actual and preferred versions of the personal form were retitled the student actual form and the student preferred form, respectively. The modification of the instrument only entailed replacing the word `science' with `chemistry' throughout. The rest of the wording of items remained unchanged. As in the SLEI, the original form of the CLEI

used in this study consisted of 35 items, with 7 items in each of the 5 scales: Student Cohesiveness, open-Endedness, Integration, Rule Clarity and Material Environment. Items are arranged in a cyclic order. However, following the item analysis reported elsewhere (Wong and Fraser, 1995) two items were deleted to form a final form of the CLEI containing 33 items altogether. A five-point scale, with the alternatives of Almost Never, Seldom, Sometimes, Often and Very Often, is used for the responses. Out of the 35 items, 13 of them are worded and scored in the reverse manner. A description of the five scales for the CLEI and an example of an item in each of them is given in Table 1.

The sample items referred to in Table 1 are from the actual version of the Student form of the CLEI (i.e., the modified version of the Personal form of the SLEI). In the preferred version, the wordings of the items are almost identical except for the use of words like would For example, the item. The teacher outlines safety precautions to me before my chemistry laboratory sessions commence in the actual version is reworded as. The teacher would outline safety precautions to me before my chemistry laboratory sessions commence in the preferred version.

Instrument validity: Wong and Freser (1995) modidied the SLEI to form the Chemistry Learning Environment Inventory (CLEI) in a study in Singapore, it was found that the CLEI was a reliable and valid instrument for assessing secondary school student's perceptions of their chemistry laboratory environment.

Table 1: Descriptive information for the chemistry laboratory environment inventory

Scale name	Description of scale	Sample item	Moos's category
Student cohesiveness	Extent to which students know, help and are supportive to one another.	Students in this laboratory class get along well as a group. (+)	R
Open-endedness	Extent to which the laboratory activities emphasis an open-ended, divergent approach to experimentation.	In our laboratory sessions, the instructor decides the best way tocarry out the laboratory experiments. (-)	P
Integration	Extent to which the laboratory activities are integrated with non-laboratory and theory classes.	We use the theory from our regular science class sessions during laboratory activities. (+)	P
Rule clarity	Extent to which behavior in the laboratory is guided by formal rules.	There is a recognized way of doing things safely in this laboratory. (+)	S
Material environment	Extent to which the laboratory equipment and materials are adequate.	The laboratory is too crowded when we are doing experiments. (-)	S

R: Relationship dimension; P: Personal development dimension; S: System, maintenance and system change dimension. Items designated (+) are scored 1, 2, 3, 4 and 5, respectively, for the responses Almost Never, Seldom, Sometimes, Often and Very Often. Items designated (-) are scored in the reverse manner. Omitted or invalid responses are scored 3

Table 2: Descriptive reliability for the actual and prefer environment

Scale	Alpha reliability act	Alpha reliability pref
Student cohesiveness	0.79	0.84
Open-endedness	0.80	0.82
Integration	0.81	0.82
Rule clarity	0.78	0.81
Material environment	0.78	0.82
Total degree	0.85	0.90

Instrument reliability: To know the reliability of the instrument, the instrument offered to sample consist of 30 students, then analysis process were made to compute cronbach alpha coefficient.

From the Table 2 we can see that the cronbach Alpha Reliability for the actual versions ranged between (0.78-0.81) and the total degree is 0.85, cronbach Alpha Reliability for the preferred versions ranged between (0.80-0.84) and the total degree is 0.90.

Data collection methods: The instrument has been applied in HZNU and JU within the second term of the 2006. The instrument was distributed directly to study sample member after explaining the goal of the study and how to deal with instrument items.

RESULTS AND DISCUSSION

One-way Analysis of Variance (ANOVA) was employed to determine if there significant difference among study sample at the 0.05 level.

Table 3 illustrate average items means for the actual form of the SLEI, Table 3 also reports the difference between males and female.

Table 3 illustrates that HZNU students perceived their actual chemistry laboratory classroom environment significantly less favourably than the JU students in the scale of Rule Clarity, while the JU students perceived their actual chemistry laboratory classroom environment significantly less favourably than the HZNU students in the scales of student cohesiveness, material environment, open-endedness and integration. Also that JU males perceived their actual chemistry laboratory classroom environment significantly less favourably than the females in scales of rule clarity and material environment,

while the females perceived the level of actual integration less favourably than the males. These two groups of students felt similarly about their actual chemistry laboratory classroom for the two other scales of open-endedness and student cohesiveness. Also that HZNU males perceived their actual chemistry laboratory classroom environment significantly less favourably than the females in the scale of rule clarity, while the females perceived their actual chemistry laboratory classroom environment significantly less favorably than the males in the scales of student cohesiveness and integration. These two groups of students felt similarly about their actual chemistry laboratory classroom for the two other scales of open-endedness and material environment.

Table 4 illustrate average item means for the preferred form of the SLEI, table also reports the difference between males and female.

Table 4 illustrates that HZNU students perceived their preferred chemistry laboratory classroom environment significantly less favorably than the JU students in the scale of Material Environment, while the JU students perceived their preferred chemistry laboratory classroom environment significantly less favorably than the HZNU students in the scales of Rule Clarity, Student Cohesiveness, Open-Endedness and Integration. Also that JU male perceived their preferred chemistry laboratory classroom environment significantly less favorably than the females in the scales of Rule Clarity, Open-Endedness and Student Cohesiveness. These two groups of students felt similarly about their preferred chemistry laboratory classroom for the two other scales of integration and material environment. Also that HZNU males perceived their preferred chemistry laboratory classroom environment significantly less favourably than the females in the scale of material environment, while the

Tble 3: Average items means for the actual form of the SLEI and the difference between males and female

Scale	University Sex	HZNU Mean	JU Mean	Total Mean	F. sex	Sig. sex	F. Uni.	Sig. Uni.
Rule clarity	Male	20.36	21.62	21.06				
	Female	20.58	22.12	21.18	9.66	00.0	144.96	0.00
	Total	20.49	21.83	21.12				
Open-endedness	Male	21.94	20.92	21.37				
	Female	21.89	20.94	21.52	0.02	0.88	79.19	0.00
	Total	21.91	20.93	21.44				
Integration	Male	22.18	19.84	20.87				
	Female	21.88	19.48	20.95	5.10	0.02	267.86	0.00
	Total	22.00	19.69	20.91				
Student cohesiveness	Male	27.29	23.00	24.89				
	Female	26.88	23.03	25.38	4.47	0.03	2127.62	0.00
	Total	27.05	23.01	25.14				
Material environment	Male	22.59	17.92	19.98				
	Female	22.56	18.16	20.85	1.08	0.30	1889.09	0.00
	Total	22.58	18.02	20.42				
Total	Male	114.36	103.30	108.17				
	Female	113.79	103.74	109.88	0.07	0.79	1986.76	0.00
	Total	114.02	103.48	109.03				

Table 4: Average item means for the preferred form of the SLEI and the difference between males and femal

Scale	University Sex	HZNU Mean	JU Mean	Total Mean	F. sex	Sig. sex	F. Uni.	Sig. Uni.
Rule clarity	Male	23.86	17.00	20.02				
	Female	23.68	17.53	21.29	5.21	0.02	7167.71	0.00
	Total	23.76	17.22	20.66				
Open-endedness	Male	25.22	22.24	23.55				
	Female	25.19	22.67	24.21	1.05	0.30	201.57	0.00
	Total	25.20	22.42	23.88				
Integration	Male	19.06	18.38	18.68				
	Female	18.96	18.33	18.72	0.44	0.51	34.30	0.00
	Total	19.00	18.36	18.70				
Student cohesiveness	Male	26.63	20.78	23.36				
	Female	26.69	21.47	24.66	2.05	0.15	444.17	0.00
	Total	26.66	21.07	24.01				
Material environment	Male	18.04	20.54	19.44				
	Female	18.34	20.59	19.22	1.69	0.19	297.07	0.00
	Total	18.22	20.56	19.33				
Total	Male	112.80	98.94	105.05				
	Female	112.87	100.59	108.09	4.19	0.04	979.43	0.00
	Total	112.84	99.62	106.58				

females perceived their preferred chemistry laboratory classroom environment significantly less favourably than the males in the scales of rule clarity and integration. These two groups of students felt similarly about their preferred chemistry laboratory classroom for the two other scales of open-ended ness and student cohesiveness.

CONCLUSION

Overall the HZNU students perceived their actual chemistry laboratory classroom environment significantly more favorably than the JU students in all scales except the scale of rule clarity, the HZNU students perceived their preferred chemistry laboratory classroom environment significantly more favorably than the JU students in all scales except the scale of Material Environment, the female students in general perceived their actual chemistry laboratory classroom environment significantly more favourably than the male students in all scales, also the female students perceived their preferred chemistry laboratory classroom environment significantly more favorably than the male students in all scales except the scale of material environment.

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