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Learning environments: Investigating the psychometrics of a measurement instrument in the language classroom context

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Abstract

The aim of this study was to provide evidence on the construct validity of the 'What is Happening in this Class' (WIHIC) questionnaire in the context of teaching English as a foreign language (EFL) in Iran. The field of language teaching has made a number of claims about the role of language learning environments (particularly the classroom) in L2 acquisition and use, but it does not provide teachers and researchers with reliable and valid instruments to assess the accuracy of these claims. To serve the purpose of the study, a sample of 607 Iranian EFL learners from both university and institute contexts was requested to complete the WIHIC questionnaire, and the obtained data were then submitted to exploratory and confirmatory factor analysis for construct validation. The results indicated that the deletion of one dimension and several items from the original WIHIC questionnaire enhanced its psychometric properties, thus confirming the validity of the questionnaire with six factors. In addition, the psychometric properties of the validated questionnaire were found to be invariant across the teaching context (i.e., university versus institute contexts). The implications of these findings for research on language learning environments are discussed, and some suggestions are made for further validation studies.

Keywords: Language learning environments, 'What is Happening in this Class?' questionnaire, factor analysis, measurement invariance

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1. Introduction

Following the motivational studies of the 1970s (Gardner & Brunet, 1977; Gardner & Lambert, 1972), more significance was attached to affective factors in language teaching and learning. Accordingly, ideal language classes were redefined as environments devoid of stress where learners could freely communicate. Building on this premise, second language (L2) teachers were urged that one of their challenging responsibilities is "to provide students with a learner-centered, low-anxiety classroom environment" (Young, 1991, p. 426). In addition, a functional L2 classroom is believed to be predictable in "featuring moderately challenging tasks, necessary instructional support, and regular experiences of success" (Joe et al., 2017; p. 139). Such a functional classroom is transparent in its goals, lets learners have control over learning tasks and allows for teaching techniques that engage L2 learners in the process of teaching and learning (Joe et al., 2017). Consequently, it affects L2 learning outcomes (Dörnyei, 2009), facilitates teacher-learner interaction (Antón, 1999; Oliver & Nguyen, 2018), builds rapport between the teacher and learners (Hann, 2016; Nguyen, 2007; Ruesch et al., 2012), raises learners' self-confidence and self-efficacy (Joe et al., 2017; Young, 1991), and boosts their motivation, positive beliefs, and cooperative participation (Chua et al., 2011; Dörnyei, 2006; Ruesch et al., 2012; Wu, 2003). The problem is that we are equipped with no valid tool to measure the accuracy of these claims. Even empirical studies examining issues related to the language classroom environment have usually outsourced the evaluation of language classrooms to instruments from general education whose reliability and ecological validity have not been established in the context of L2 teaching and learning. Unlike language teaching, other fields of education have been long assessing the mechanisms of learning environments (LEs) via reliable and valid instruments, including *Learning Environment Inventory (*Walberg & Anderson, 1968), Classroom Environment Scale (Fisher & Fraser, 1983), Classroom Climate Scale (López et al., 2018), University-Level Environment Questionnaire (Dorman, 1998), Constructivist Learning Environment Survey (Taylor et al., 1997), What is Happening in this School (Aldridge & Ala'i 2013), and What is Happening in this Class (Aldridge et al., 1999; Skordi & Fraser, 2019). Most of these instruments have been validated and translated with different groups of students, in different subject matters, and in different languages.

2. Review of Literature

The significance of LEs is increasingly recognized in different fields of education, with a scientific journal devoted to the topic, i.e., *Learning Environments Research*. The early work on LEs was part of the Harvard Project Physics (Walberg & Anderson, 1968), which offered ideas about how the environmental factors would affect students' motivation for learning and provided opportunities for research in both classroom and laboratory contexts. Since the Harvard Project Physics, educational researchers have shown interest in tracing the dimensions that determine teachers' and students' perceptions of LE factors. The ultimate purpose of this research agenda is to examine whether these factors would influence learning outcomes in education and how the factors could be intervened, so that teaching and learning would happen in a more positive LE.

Teachers and students are usually the factors that have the most influence on classroom LEs. All the existing theories (e.g., Bear, 2015; Fraser, 1998, 2012; Moos, 1974; Nguyen, 2007) contend that the relationship between the teacher and students is the immediate determinant of a favorable classroom LE. According to Bear (2015, p. 26), establishing "warm, close, and supportive relationships is instrumental to both maintaining order and developing self-discipline" in the classroom. Particularly, a supportive teacher assures students that there will be help when they need it, that their mistakes will be tolerated, and that his/her ultimate aim is to provide a context for fulfilling their learning potentials (Bear, 2015; Fraser & Walberg, 2005). A nourishing classroom environment also establishes rapport among students, i.e., they "will provide support and encouragement for each other, and engage in efforts to understand each other's meaning. In these ways, they will assist each other in achieving the learning goals established and valued within the classroom culture" (Bear, 2015, p. 139). What matters here is that students in the class environment form a cohesive unit where the learning outcomes for all students depend on the outcomes obtained by individual students. In the literature, student cohesiveness is believed to be next to the teacher-student relationship as far as its effects on a functional LE are concerned (e.g., Fraser, 2012; Goetz et al., 2013; Hann, 2016). Together, they involve students in the processes happening in the classroom. Involvement (also known as engagement) is considered the prerequisite for later higher-order levels of learning in the classroom. In an efficient LE, the learner's cognitive engagement cannot be well achieved unless the instructional tasks are designed

in that direction. In other words, in the learning process, the friendly atmosphere of an LE is only facilitative to students' cognitive engagement; it is the orientation of the classroom tasks that claim a causative role in this area. Task orientation can be defined as the goals for performing an educational task and the procedures set to achieve these goals (see Oliver et al., 2007). For instance, in language teaching, it is well known that tasks with interesting and familiar topics, tuned to learners' current L2 proficiency, and performed under controlled conditions are more likely to have cognitive appeals to learners (Ellis, 2009; Philp & Duchesne, 2016; Qiu & Lo, 2017).

On the other hand, the issues of equality, democracy, inclusiveness, responsibility, anti-discrimination, and constructive competition are among the factors helping teachers immerse students in the flow of classroom teaching. These issues have been less empirically researched, but researchers are unanimous that an effective LE sets its goals beyond learning outcomes to address broader social issues. For instance, it is believed that an inclusive classroom with mixed-abilities students is more prone to a socialized LE, which is in return leads to wider social justice (Bates, 2006). Similarly, when learners feel they are treated equally, they show more eagerness to participate in learning activities and undertake functional classroom roles (Marjoribanks, 1991). Finally, educational responsibility mandates that both the teacher and learners try to empower all the classroom parties (teacher, student, and classmates) so that educational resources are spent as efficiently as possible (Young, 2005).

Language learning environments (LLEs) are characterized by several features that distinguish them from other learning contexts. First, the language classroom is more interactive, as it is believed that interaction is the medium through which an L2 is communicatively acquired (Duff, 2000; Gil, 2002; Moore, 2013). In contrast to other subject matters (e.g., physics, mathematics, etc.), which are less interactive and more teacher-fronted, the language teacher and learners are immersed in reciprocal communication so that communicative L2 competence is improved on the part of the learners. Furthermore, in the process of teaching and learning, language classrooms would engage learners' emotions more intensely. Although emotions such as anxiety and enjoyment are decisive factors in other LEs (Goetz et al., 2013), they are rather all-present in LLEs as they are more immediately linked to the L2 learner's affective evaluation of his/her language learning and performance (Dewaele, 2015; Imai, 2010). It can explain why concerns over emotions in LEs are more prevalent in language learning research than in other educational areas. The

implication of this proposition is that teachers should create a classroom atmosphere in which the debilitative effects of negative emotions (e.g., anxiety, hopelessness, etc.) are alleviated, while the 60facilitative effects of positive emotions (e.g., enjoyment, happiness, well-being, etc.) are boosted as much as possible. Finally, LLEs happen in a variety of contexts; language classrooms are either held in private institutes, schools, universities, or online, among others. There are overlaps between these contexts and the classroom contexts for other subject matters, yet there are some contexts (e.g., private institutes) that are more characteristic of language classrooms. This last point implies that instruments developed for assessing LLEs should seriously take the institutional contexts into account. On the other hand, learning in EFL contexts is more influenced by classroom–environmental factors than learning in other language learning contexts (e.g., English as a second language, English as a heritage language, etc.). The reason is that EFL learning is bound to the classroom walls, with learners having limited opportunity to make use of their L2 knowledge in real-life situations outside the classroom, which would probably make them more critical of the efficacy of their teachers and other classroom factors facilitating or hindering their language learning processes (Phan & Locke, 2015).

It seems justifiable to claim that LEs constitute an area in educational research with much effort spent on developing instruments for measuring different aspects of LEs. Fraser (1998) referred to this more than two decades ago:

> A historical look at the field of learning environment over the past few decades shows that a striking feature is the availability of a variety of economical, valid and widely-applicable questionnaires that have been developed and used for assessing students' perceptions of classroom environment. Few fields in education can boast the existence of such a rich array of validated and robust instruments which have been used in so many research applications. (pp. 7-8)

Historically speaking, the first instrument was developed in the aforementioned Harvard Project Physics in the late 1960s (Walberg & Anderson, 1968). The Learning Environment Inventory (LEI) included 105 items rated across a four-point Likert scale over 15 dimensions. This instrument has been the most popular with experiential learning fields such as Medicine and Laboratory (e.g., Chan, 2003; Newton et al., 2010; Wong & Fraser, 1995). Although less used in other educational fields, the LEI has paved the way for a wide range of instruments in these fields.

For instance, Moos (1974, 1979) and Moos and Trickett (1987) undertook a comprehensive research program to investigate human performance and learning in different environments, including prisons, clinics, hospitals, and universities, among others. For universities, the researchers developed the Classroom Environment Scale (CES), which included 90 True-False items over nine dimensions. In a similar way, Fisher and Fraser (1981) and Fraser and O'Brien (1985) drew on the LEI in order to develop their My Class Inventory (MCI); the MCI was in fact a simplified version of the LEI particularly developed for primary school and high school children (aged 8-12). The long version of the instrument consists of 38 items, while a short form of the instrument consists of 25 items along a Yes/No scale. A third LE instrument, i.e., Questionnaire on Teacher Interaction (QTI), was developed by Wubbels and his associates (Wubbels & Brekelmans, 1998; Wubbels & Levy, 1993). Based on the concepts of proximity and influence, the QTI was more focused in its purpose, as it dealt with interpersonal relationships between teachers and students. The long and short versions of the QTI consisted of 64 and 48 items, respectively, along a five-point scale ranging from Never to Always.

Although the above instruments are still used in education to assess students' and teachers' perceptions of LEs, the most widely applied instrument for such a purpose is the 'What is Happening in this Class (WIHIC)' questionnaire, developed by Fraser and colleagues (e.g., Aldridge et al., 1999; Fraser et al., 1996). The WIHIC questionnaire was developed by integrating the existing LE instruments in different fields of education to provide teachers and researchers with a user-friendly and economically applicable instrument for the evaluation of classroom contexts. The original version of the questionnaire had 90 items across nine dimensions, including items and dimensions appealing to educational researchers and practitioners at the time (e.g., equity and constructivism). Later quantitative and qualitative analyses provided evidence that a seven-dimensional structure could better explain students' perceptions of LEs, and thus the later conceptualizations of the WIHIC questionnaire were mostly along with this seven-dimensional structure. This updated version consisted of 56 items, i.e., eight items per dimension. Table 1 presents the updated seven-factor structure of the WIHIC questionnaire, along with descriptions and sample items for each factor/dimension (Fraser, 2012).

Table 1. *WIHIC dimensions* (Aldridge, 2012, p. 1266)

Dimension	Description (The extent to which …)	Sample Item
Student Cohesiveness	Students know, help and are supportive of one another.	Students in this class like me.
Teacher Support	The teacher helps, befriends, trusts and is interested in students.	The teacher is interested in my problems.
Involvement	Students have attentive interest, participate in discussions, do additional work and enjoy the class.	I explain my ideas to other students.
Investigation	Emphasis is placed on the skills and processes of inquiry and their use in problem solving and investigation.	I find out answers to questions by doing investigations.
Task Orientation	It is important to complete activities planned and to stay on the subject matter.	I know the goals for this class.
Cooperation	Students cooperate rather than compete with one another on learning tasks.	I work with other students on projects in this class.
Equity	Students are treated equally by the teacher.	The teacher gives as much attention to my questions as to other students' questions.

Since its development, the WIHIC questionnaire has been widely validated, translated, and used in different fields of education. It has been translated and validated in Arabic (Afari et al., 2013; Khalil & Aldridge, 2019), Chinese (Aldridge & Fraser, 2000; Yang et al., 2002), Creole (Allen, 2003), Indonesian (Margianti et al., 2004), Korean, and Spanish (Peiro & Fraser, 2009). In addition, the questionnaire has been used and validated with students and populations of different ages and in different subject matters, including sciences (Kim et al., 2000), business statistics (Skordi & Fraser, 2019), and mathematics (Afari et al., 2013; Deieso & Fraser, 2019). However, validation of the instrument in language teaching and learning contexts has been relatively overlooked. In a recent study, Lim and Fraser (2018) validated the questionnaire in language learning, yet there were some limitations to their validation results. Lim and Fraser (2018) had just partially validated the WIHIC questionnaire, as the main focus of their study was not to

substantiate the psychometric properties of the questionnaire; rather; they aimed to examine the relationship between the language classroom environment with a set of demographic and learner-related variables, including gender, ethnicity, and attitudes. Consequently, the researchers only employed exploratory factor analysis for their validation purpose. In addition, the sample with which the WIHIC questionnaire was used and validated included learners aging around 12 years, making it difficult to generalize their validation results to other populations of language learners. Thus, it seems that the need to validate the WIHIC questionnaire is still rather unmet, and therefore the present study was conducted to fill this gap.

3. Purpose of the Study

The present study set out to examine the psychometric properties of the WIHIC questionnaire in the context of teaching and learning EFL in Iran. This questionnaire is the most commonly used instrument for assessing LEs (Skordi & Fraser, 2019) and is widely employed in research on LLEs (Alzubaidi et al., 2016; Bi, 2015; Khajavy et al., 2016; Khajavy et al., 2018; Sun, 2009, 2010), although its construct validity has not yet been well-substantiated in this research area. At a local level, a review of the past literature by Lim and Fraser (2018) indicated that Iran is one of the EFL contexts in which the most research on language classroom environments has been undertaken (e.g., Bardach et al., 2018; Jannati & Marzban, 2015; Khajavy et al., 2016; Khajavy et al., 2018). Thus, preparation and validation of instruments for assessing language classroom environments would not only contribute to the current knowledge about the psychometric properties of these instruments, but access to such instruments would also be helpful to both Iranian teachers and researchers. The study is also set to examine whether these psychometric features are invariant across different EFL contexts (i.e., university versus institute contexts), since a measure designed to assess LEs should be applicable to a wide range of teaching and learning contexts (Fraser, 1998; Moos, 1979). In addition, a recent trend has emerged in the Iranian EFL research to compare various language learning contexts with respect to different variables (e.g., Gholami et al., 2016; Moradkhani & Haghi, 2017; Razmjoo, 2007; Zarei et al., 2019). Thus, again, validation of the WIHIC questionnaire within the Iranian EFL setting would be of much help to this new research trend.

4. Method

4.1. Participants

A sample of 607 EFL learners from different language classrooms in different cities in Iran participated in this study. As for the context, 329 respondents (54.2%) were sampled from the university context, while 278 respondents (45.8%) were sampled from the institute context. Regarding their gender, 381 respondents (62.8%) were female, and 226 respondents (37.2%) were male. The participants' ages ranged from 14 to 39 (M = 22.3, SD = 3.7). The participants were from all levels of English language proficiency. Yet, due to the unavailability of the related data, it was not possible to categorize the participants based on their proficiency levels.

4.2. Instrumentation

In the present study, the final form of the WIHIC questionnaire was used (Aldridge et al., 1999). This form of the instrument consists of 56 items subsumed under seven dimensions, each having eight items. Previous research has provided evidence that this form of the instrument has more robust psychometric properties than the earlier forms. The items in the questionnaire are rated on a five-point Likert scale, i.e., Almost never, Rarely, Sometimes, Often, Almost always.

The English version of the WIHIC questionnaire (Aldridge et al., 1999) was mainly employed to collect the required data. Yet, to collect data from learners with low English proficiency, the questionnaire was also translated from English into Persian by the researchers. The Persian-translated version was then submitted to an experienced translator for back-translation. Once the questionnaire was back-translated, the inconsistencies between the Persian version and the back-translated version of the questionnaire were resolved in a panel discussion involving the researchers. Finally, the questionnaire underwent a pilot study with 43 Iranian EFL learners. The results showed that both the content and language of the items were clear to the students, and they could answer the items smoothly.

4.3. Data collection

The process of data collection in this study happened in ongoing formal language classrooms to let the respondents have an online evaluation of the LLE in their classrooms. For each data collection session, one of the researchers entered the classroom. He first explained the purpose of the study to the learners and asked them if they were willing to complete the WIHIC questionnaire. The learners were informed that their identities would be kept confidential. Then, the questionnaire was handed out to the volunteers (i.e., respondents). The researcher present in the data collection session went around the respondents to answer their questions regarding the language and content of the items. The respondents were told that they had the liberty to change their responses when deemed necessary. It took about 20 to 30 minutes for each respondent to complete the questionnaire. Around 83 and 17 percent of the respondents completed the English and Persian-translated version of the questionnaire, respectively.

5. Results

The statistical analyses in this study were conducted at three stages, i.e., exploratory factor analysis (EFA), confirmatory factor analysis (CFA), and measurement invariance. As of the software, we employed SPSS 19 to conduct EFA and LISREL 8.72 to conduct CFA and measurement invariance.

5.1. Exploratory factor analysis

The EFA results revealed that the Kaiser–Meyer–Olkin index was 0.86, and Bartlett's test of sphericity was statistically significant ($p < .001$), meaning the WIHIC items were strongly inter-correlated for the purpose of factor analysis (Pallant, 2020). Principal Axis Factor (PAF) analysis based on Promax rotation extracted six factors, which collectively accounted for 49.4% of the total variance in the participants'' scores on the questionnaire. Individually, the extracted factors explained 23.76%, 7.68%, 6.04%, 5.32%, 3.37% and 2.62% of the total variance. As seven dimensions had been originally proposed for the WIHIC questionnaire (Aldridge, 2012; Aldridge et al., 1999), these results meant that one of the original dimensions should be discarded. An

inspection of the scree plot (Figure 1), factors explaining over one eigenvalue, factor loadings, and results of parallel analysis substantiated that the 'Investigation' dimension was contributing to the total variance less than expected. Consequently, the 'Investigation' dimension and its respective items were totally removed from further analyses. The EFA results also indicated that, of the remaining WIHIC items, 36 items had a factor loading within the acceptable limit (i.e., > .5; Tabachnick & Fidell, 2001), as shown in Table 2. For ease of readability, the items in Table 2 have been renumbered to represent Item 1 to Item 36. Table 2 also shows the reliability indices of the whole questionnaire and its subscales. As is seen, the whole WIHIC questionnaire had a reliability of .92, and the reliability of its subscales ranged from .72 (Cooperation) to .86 (Student Cohesiveness). All these reliability values are above the threshold level, which is .70 (Dörnyei & Taguchi, 2009).

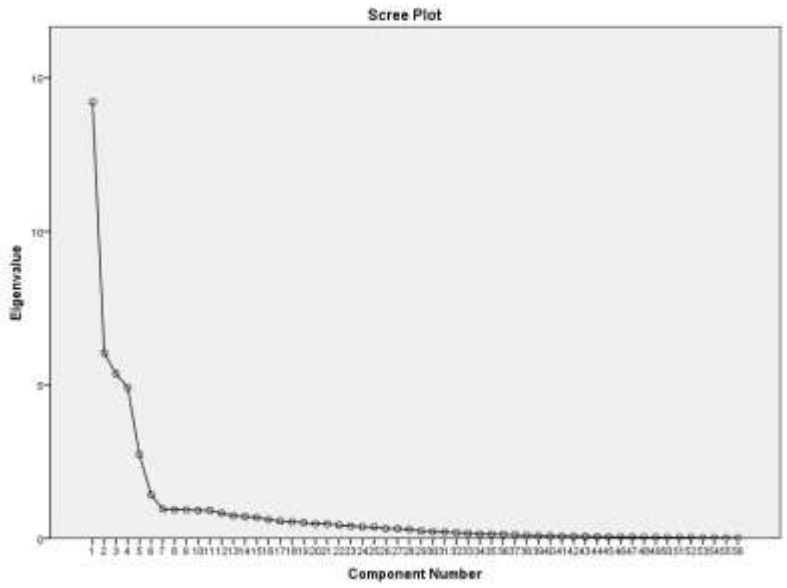

Figure 1. The Scree Plot of the PAF Analysis

Table 2. *The factor loadings of the items*

	WIHIC questionnaire (36 items, total r = 0.92)	**F1**	**F2**	**F3**	**F4**	**F5**	**F6**
	Student Cohesiveness (8 items, r = 0.86)						
1.	I am friendly to members of this class.	.76					
2.	In this class, I get help from other students.	.83					
3.	I know other students in this class.	.61					
4.	I work well with other class members.	.92					
5.	I make friendships among students in this class.	.78					
6.	I help other class members who are having trouble with their work.	.69					
7.	Students in this class like me.	.81					
8.	Members of the class are my friends.	.63					
	Teacher Support (6 items, r = 0.80)						
9.	The teacher's questions help me to understand.		.59				
10	The teacher helps me when I have trouble with the work.		.80				
11.	The teacher considers my feelings.		.79				
12.	The teacher takes a personal interest in me.		.74				
13.	The teacher is interested in my problems.		.63				
14.	The teacher moves about the class to talk with me.		.91				
	Involvement (7 items, r = 0.82)						
15.	I ask the teacher questions.			.87			
16.	I explain my ideas to other students.			.84			
17.	The teacher asks me questions.			.61			
18.	I give my opinions during class discussions.			.59			
19.	Students discuss with me how to go about solving problems.			.58			
20	My ideas and suggestions are used during classroom discussions.			.86			

21.	I am asked to explain how I solve problems.	.80			
	Task Orientation(6 items, r = 0.80)				
22.	I know how much work I have to do.		.89		
23.	I know what I am trying to accomplish in this class.		.68		
24.	I pay attention during this class.		.63		
25.	I know the goals for this class.		.71		
26.	I am ready to start this class on time.		.74		
27.	I try to understand the work in this class.		.72		
	Cooperation (4 items, r = 0.72)				
28.	I learn from other students in this class.			.82	
29.	I cooperate with other students on class activities.			.68	
30.	I work with other students in this class.			.74	
31.	I share my books and resources with other students when doing assignments.			.79	
	Equity(5 items, r = 0.77)				
32.	The teacher gives as much attention to my questions as to other students' questions.				.60
33.	I get the same opportunity to answer questions as other students.				.62
34.	I get the same amount of help from the teacher as do other students.				.79
35.	I receive the same encouragement from the teacher as other students do.				.81
36.	I am treated the same as other students in this class.				.57

*F = factor

5.2. Confirmatory factor analysis

Based on the EFA results reported above, a six-factor model was hypothesized for the use of the WIHIC questionnaire in the EFL context. The six dimensions of the model included *Student Cohesiveness* with eight items, *Teacher Support* with six items, *Involvement* with six items, *Task Orientation* with six items, *Cooperation* with five items, and *Equity* with six items. Afterward, the psychometric properties of the hypothesized six-dimension model were compared with a one-dimension model to provide evidence on the dimensionality of the language classroom environment. On the other hand, it was decided that the six-dimension model be also compared with the seven-dimension model originally proposed for the WIHIC questionnaire to examine whether the decision to delete one dimension (i.e., 'Investigation') was tenable.

A number of goodness-of-fit statistics were employed for CFA (Brown, 2006; Kline, 2015). The statistics included the root mean square error of approximation (RMSEA), standardized root mean square (SRMR), Tucker-Lewis index (TLI), and comparative fit index (CFI). The values of RMSEA and SRMR should be respectively lower than .06 and .08 for a fitting model. Further, the values of TLI and CFI should be higher than .90 so that a model can be considered fit. In addition, two relative goodness-of-fit indices were also examined, which are particularly tuned for model comparison; i.e., Akaike information criterion (AIC), Bayesian information criterion (BIC). In CFA, the less the AIC and BIC values are, the more favorable the structural model is (Brown, 2006). Table 3 presents the results of the comparisons of the goodness-of-fit indices between the three models hypothesized in this study. Based on the comparative results in Table 3, it is clear that the hypothetical model with six dimensions has more favorable goodness-of-fit statistics than the rival models. Thus, a six-factor structure was established for the use of the WIHIC questionnaire in EFL classrooms. The graphical representation of the six-factor model is given in Figure 2.

Table 3. *Comparison of the three hypothesized models*

Fit index	Criterion	One-factor model	Six-factor model	Seven-factor model
χ^2	———	1432.24	588.17	685.06
RMSEA	.06>	.063	.036	.042
SRMR	.08>	.068	.049	.051
TLI	.90<	.65	.93	.89
CFI	.90<	.69	.92	.85
AIC	Lower value	50,328.94	48,864.43	49,327.27
BIC	Lower value	50,646.31	49,081.58	50,128.68

*χ^2 = Chi-square, RMSEA = root mean square error of approximation, SRMR = standardized root mean square, TLI = Tucker-Lewis index, CFI = comparative fit index, AIC = Akaike information criterion, BIC = Bayesian information criterion.

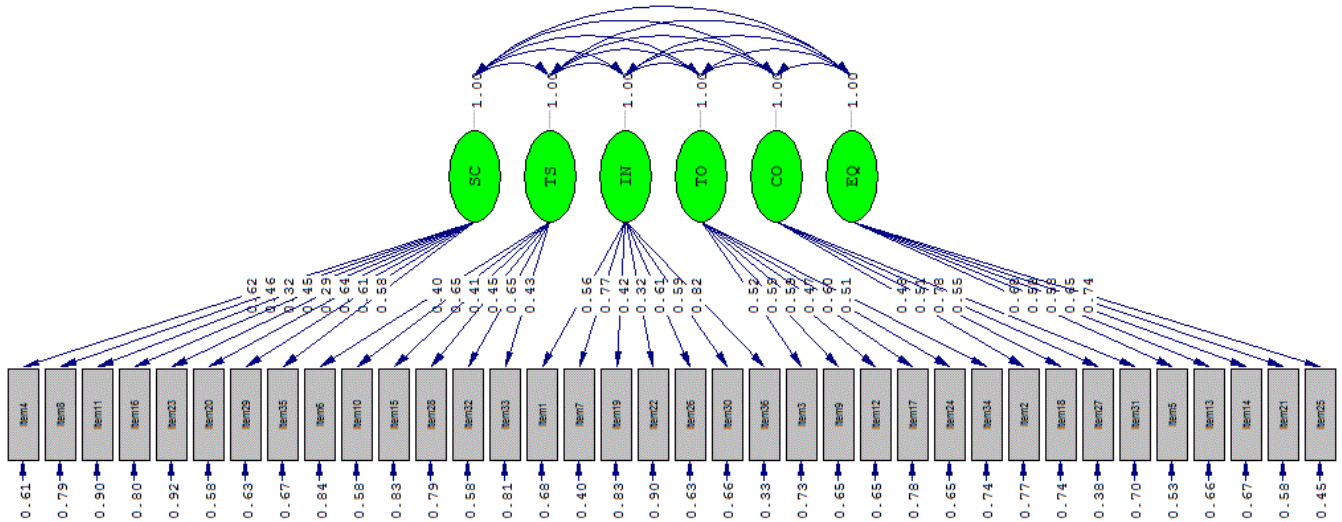

Figure 2. The Final Model of the WIHIC Questionnaire in Language Learning (Six Dimensions, 36 Items); SC = Student Cohesiveness, TS = Teacher Support, IN = Involvement, TO = Task Orientation, CO = Cooperation, EQ = Equity.

Table 4 indicates the inter-correlations among the six factors of the WIHIC questionnaire as substantiated in this study. As is seen from Table 4, the inter-correlations range from .192 (Involvement and Equity) to .501 (Teacher Support and Task Orientation). These low-to-moderate inter-correlations mean that we do not need to worry about the collinearity between the factors, and thus the decision to form a six-factor model for the questionnaire is also substantiated in this respect.

Table 4. *Inter-correlations among the factors*

Factor	F1	F2	F3	F4	F5	F6
F1	1.00	——	——	——	——	——
F2	.356	1.00	——	——	——	——
F3	.263	.325	1.00	——	——	——
F4	.481	.501	.453	1.00	——	——
F5	.285	.438	.215	.380	1.00	——
F6	.396	.246	.192	.402	.264	1.00

*F1 = Student Cohesiveness, F2 = Teacher Support, F3 = Involvement, F4 = Task Orientation, F5 = Cooperation, F6 = Equity

5.3. Measurement invariance

Measurement invariance analysis is an extension of structural equation modeling with the purpose of examining whether the structural model substantiated for a construct, or a set of constructs, varies across groups of participants (Meredith, 1993; Vandenberg & Lance, 2000). Psychometricians highlight the importance of substantiating the measurement invariance of a measure or test, i.e., we cannot make a comparison between groups of learners via an instrument until its measurement invariance is confirmed. Even about the instruments validated with undifferentiated (ungrouped) samples, this holds true (Vandenberg & Lance, 2000). In this study, multi-level factor analysis was employed to examine the measurement invariance of the WIHIC questionnaire across two LLEs (universities versus institutes).

In multi-level factor analysis, several models are hypothesized and then tested whereby, in successive steps, constraints are imposed to the base model (i.e., the model substantiated via CFA). A configural model presupposes that the patterns of the obtained factor loadings are invariant across the groups of interest; a metric model presupposes that the factor loadings are equal across the models; and finally, a scalar model assumes that the item intercepts are equal across the models (Vandenberg & Lance, 2000). As a fit index for measurement invariance, a chi-square distribution ($\Delta\chi 2$) shows the difference in the chi-squares of two consecutively constrained models that have degrees of freedom equal to the difference in the degrees of freedom of the consecutive models (Vandenberg & Lance, 2000). When the amount of the difference (i.e., $\Delta\chi 2$) is statistically non-

significant, it means that the constraints imposed on the base CFA model have not deteriorated its fit, and thus measurement invariance is established across the groups of interest.

Table 5 presents the results of measurement invariance of the WIHIC questionnaire across university versus institute contexts. Here, you should note that the comparative indices of AIC and BIC in Table 3 are not usually reported in measurement invariance as the constrained models are not supposed to compete with each other. Table 5 shows that all the three constrained models of the WIHIC questionnaire meet the criteria of the CFA fit indices. Besides, the differences in the degrees of freedom between the constrained models are not statistically significant ($p > .05$). The differences are $\Delta\chi2 = 862.9$ (p-value = .21) for the configural model, $\Delta\chi2 = 52.7$ (p-value = .43) for the metric model, and $\Delta\chi2 = 44.3$ (p-value = .36) for the scalar model. Overall, these results mean that the WIHIC questionnaire measures parallel constructs of LLEs in both university and institute contexts, and thus the measurement invariance of the instrument is established across this contextual variable.

Table 5. *The results for measurement invariance across the context*

Fit index	Criterion	Base model	Configural model	Metric model	Scalar model
RMSEA	.06>	.04	.05	.05	.05
SRMR	.08>	.04	.05	.05	.05
CFI	.90<	.94	.93	.93	.93
TLI	.90<	.93	.92	.93	.92
$\Delta\chi2$			862.9	52.7	44.3
p-value	p> .05		.21	.43	.36

6. Discussion and Conclusion

This study was undertaken in order to validate an instrument (i.e., the WIHIC questionnaire) for assessing language teaching and learning classroom environments in the EFL context. The required data were collected from both university and institute contexts to examine whether the

psychometric properties of the WIHIC questionnaire were invariant across these two EFL contexts. The EFA results showed that one dimension (i.e., 'Investigation') in the original WIHIC questionnaire did not significantly contribute to the total variance in the participants' responses to the WIHIC items. Therefore, this dimension and its respective items were discarded from the revised draft of the WIHIC questionnaire. Further, based on this decision and the results of factor loading analysis, 36 items were retained in the revised draft.

Based on the EFA results, a six-factor model was hypothesized for the use of the WIHIC questionnaire in the EFL context, and the model was submitted to CFA for construct validation. Two other structural models (i.e., one-factor and seven-factor) were also tested for the purpose of comparison. The CFA results indicated that the six-factor model had more favorable goodness-of-fit indices than the one-factor model, indicating that the LLE is multi-dimensional in nature. The six-factor model was also compared with the seven-factor model originally proposed by the designers of the WIHIC questionnaire (Aldridge, 2012; Aldridge et al., 1999), and the results showed that the six-factor model had better fit indices. It is worth noting that this latter finding should not be interpreted as totally disconfirming a seven-factor solution for the WIHIC questionnaire. Evidence on a seven-factor structure is robust enough to claim that it applies to most LEs in different subject matters. In LLEs in foreign language contexts, however, a six-factor structure is deemed more interpretable, as the dimension discarded in the present study (i.e., 'Investigation') could not contribute enough variance to the measurement of the classroom LLE. The reason might be that the items of the 'Investigation' dimension assessed content inquiry and offline problem-solving skills (e.g., *I carry out investigations to test my ideas*); learners of English for general purposes often worry less about these skills, since their learning is often assessed in purely linguistic terms. As a note, this is in stark contrast to, for example, English-Medium Instruction and Content and Language Integrated Learning in which achievement is defined both academically and linguistically (Wannagat, 2007), and thus opportunities for inquiry and problem-solving may play a significant role in learners' LE perceptions. Finally, the results of the study demonstrated that the six-factor model constructed for the WIHIC questionnaire in the EFL context was invariant across university versus institute contexts.

Given the above evidence on the valid use of the WIHIC questionnaire in the EFL context, it is now claimed that this instrument can be employed to assess the environment of EFL language

classrooms reliably and validly. Access to such a reliable and valid instrument is particularly useful for the growing research on LLEs in EFL contexts (Lim & Fraser, 2018). Language teachers can also benefit from the WIHIC questionnaire to examine whether the EFL classroom environment they have created for their students is responsive to their learning needs and engage their cognitive and affective resources in the process of language teaching. Moreover, language administrators and stakeholders can make use of the questionnaire for classroom and program evaluation. Of course, the efficacy of an LLE should also be evaluated against actual learning outcomes, since LLEs are not considered effective if they do not bear desirable learning outcomes. The validation agenda followed in the present study can be continued in several directions. First, since the reliability and validity of the WIHIC questionnaire in the EFL context are now established, cross-validation of other LE instruments can be performed against the WIHIC questionnaire as the yardstick for criterion validation. Second, the present study examined the measurement invariance of the WIHIC questionnaire across two different LLEs, i.e., university versus institute. However, there is a wide range of factors that are usually targeted for between-group studies when it comes to L2 teaching and learning. These factors include, but are not limited to, gender, proficiency, age, and individual differences. Thus, it is suggested that the measurement invariance of the WIHIC questionnaire also be examined across these factors. Finally, the present study used both exploratory and confirmatory factor analysis to substantiate the construct validity of the WIHIC questionnaire. However, factor analysis is unable to address all aspects of the construct validity of a psychological or educational instrument, such as item and scale functioning. These validation aspects can be tackled via other statistical tools (e.g., Rasch analysis), which can be employed in future validation studies of LE instruments in L2 teaching and learning contexts.

7. References

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