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The Turkish adaptation study results of constructivist learning environments scale: Confirmatory factor analysis results

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Abstract

The aim of this study is to explore the confirmatory factor analysis results of the Turkish adaptation of constructivist learning environment scale student version, developed by Aldridge, Fraser, Taylor & Chen (2000). The validity and reliability assessments of the scale were performed on 1094 students chosen randomly from primary schools in Eskişehir and İstanbul city centers. The confirmatory factor analysis (CFA) was carried out so that factor structures of the Turkish adaptation of Constructivist Learning Environment Scale could be determined. The results from the confirmatory factor analysis revealed that the Turkish adaptation of the original scale, comprising five factors and 30 items, actually consisted of 21 items. The five-factor structure of the original scale, on the other hand, remained the same.

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Keywords: Constructivism; learning environment; scale adaptation; confirmatory factor analysis; validity and reliability .

1. Introduction

Constructivism is essentially based on learners' constructing their own knowledge instead of reproducing someone else's knowledge (Moussiaux & Norman, 2003). Thus, students have the control of their own learning processes. According to Dunlop & Grabinger (1996), students in constructivist learning processes are supposed to be aware of their own cognitive process, to arrange these processes and to be able to analyze the efficiency of the learning processes they employ during learning activities.

Constructivist teaching considers students' previous knowledge, skills and experiences as a base for new learning. Students therefore learn any new scientific piece of knowledge by relating them to their previous experiences. Since teaching outcomes cannot be anticipated beforehand, teaching performs a supportive function rather than a controlling one. That is why constructivist approach focuses on how students will learn better more than what and how they are taught (Yaşar, 1998; Yaşar, Gültekin & Anagün, 2005; Anagün, 2008).

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Constructivist theory holds that another significant factor affecting the construction of knowledge is socio-cultural structure where learning-teaching process takes place. Knowledge, in socio-cultural sense, is constructed by coming up with meaning based on what has already been known from their previous experiences. In learning-teaching process, stages aimed at demonstrating the result of an activity such as preparation, accessing resources, peer discussion, presentation of the right and wrong and of the content are requirements for the social structure of learning and these stages themselves require learner collaboration. The role of teacher in this process is therefore to facilitate learning process instead of transferring knowledge. In this process, teacher is to provide each student with the materials and learning situations that will yield meaningful learning (Peters & Stout, 2006).

The basic characteristic of constructivist learning environments is that a lesson is initiated with the questions or activities which students are likely to find interesting. As a result, students should be presented with activities they will probably regard worth spending time on and dealing with. Teachers in constructivist learning environments should carefully listen to students' interpretation of the results from the data they gather during their research and show a special interest in each student's problems, unclear or confusing experiences. Teachers in constructivist learning environments should also pay attention to opinion differences in classroom and show everyone respect equally.

Another feature of constructivist learning environments is that the flow of a lesson could be changed when necessary in accordance with the suggestions from students. Taking students' opinions about the subject to be learnt into consideration and determining their perspectives are extremely important for arranging learning content. A teacher determining learner thoughts and ways of thinking will not have difficulty in determining in which contexts and how to realize learning more meaningfully. For this reason, in constructivist learning environments, students should be provided with learning experiences contrasting their ideas at the beginning of teaching-learning process so that they consider things from different points of views and they perform discussions. In constructivist learning environments, giving student's opportunity to have peer discussion on their ideas not only increases academic achievement and motivation but it also ensures that students study efficiently and set up proper relationships with others.

The fact that a constructivist classroom does not regard science as a sum of static and unchanging facts is one of its distinguishing qualities. Teachers, in constructivist learning environments, where science is seen as an active process, provide their students with opportunities to work like scientists and to express their feelings by taking their beliefs about science into account (Julyan & Duckworth, 2005). This, in return, contributes to students getting to know more about the nature of science.

2. Method

This is a scale adaptation study. The study made use of the student version of constructivist learning environment scale developed by Aldridge, Fraser, Taylor & Chen (2000). The information concerning this process is presented in the relevant subtitles.

2.1. Sample

The subjects of the research consisted of 1145 students from 8 elementary schools in Eskisehir and 7 elementary schools in Istanbul. After eliminating the questionnaires which had missing and extreme values, the analyses were carried out on 1094 valid questionnaires for constructivist learning environment scale.

2.2. Measurement instrument

“Constructivist Learning Environment Scale” as an instrument assessing constructivist learning environments was developed in 1991 by Taylor & Fraser. Mainly focusing on considering students' conceptual progress from a constructivist perspective, the scale was then revised appropriately for social constructivism principles and extra items emphasizing teacher-student interaction were added to it (Aldridge, Fraser, Taylor & Chen, 2000; Taylor, Fraser & Fisher, 1997). The scale was found to be significant in that it highlighted the principles of constructivism, the importance of learning taking place in an authentic context and of students performing studies in the subjects they are interested in. The original scale to be adapted to Turkish measures students' perceptions about their own

learning environments by means of five sub-scales consisting of 30 items. Each sub-factor consists of six items. The statements are phrased as: almost always, often, sometimes, rarely or almost never. A five-point Likert scale was designed and these responses were numbered 5-4-3-2-1. Negative statements, on the other hand, were evaluated in reversing order. The inner reliability of the original scale was determined through Cronbach Alpha and was found to be higher than .70.

2.3. Translation and Turkish-English equivalency of the Scale

In adapting the scale to Turkish, two academics specialized in English language independently translated the scale into Turkish, compared the two Turkish versions and finally got one version out of them. The expressions in the original language remained unchanged as much as possible but with few obligatory changes because of translation problems. The Turkish version of the scale was again translated into English by two different experts, the versions were compared once more and the scale took its final form. In order to test comprehensibility of the adapted scale for primary school fifth graders, one-to-one interviews were conducted with 30 fifth graders chosen randomly. During the interviews applied by the researchers, students were asked what they understood by each statement and what revisions they recommended for the statements so that they could be clarified. Finally, by trying hard to keep the same meaning of the statements, necessary changes were made in light of the feedback from sampled students so that they could be appropriately comprehended by fifth grade primary school students.

2.4. Statistical analysis

Before the analyses of the gathered data, the forms filled in incomplete, wrong, or extreme values were removed from the data set. In the determination of extreme values, the scale scores were transformed to z-standard scores and in the right and left of the mean, the scores that were outside of the 3.00 standard deviation were accepted as the extreme values.

The confirmatory factor analysis was used in order to test the scale's factor structure (construct validity). Lisrel 8.72 was employed to conduct confirmatory factor analysis (CFA). Corrected item-total correlation was calculated in order to examine the item validity. Confirmatory factor analysis is performed to verify the confirmation of a pre-determined structure (Şimşek, 2006). At this step, the extent to which the model explains the data collected well is determined by means of goodness of fit indices. Goodness of fit tests helps make a decision about accepting or refusing the model.

3. Findings

A confirmatory factor analysis (CFA) was performed to determine the factor structures of the CLES (constructivist learning environments scale). The analysis was initiated with 30 items. As a result of CFA, conducted in order to assess the extent to which the 30 items in the original scale and the five-factor structure determined and the data gathered with this study fit together, it was found out that the 3rd, 6th, 7th, 11th, 17th, 18th, 21st, 25th, and 29th items displayed loading tendencies towards other implicit variables in addition to those implicit variables already anticipated theoretically and these items were removed from CLES as well to create conceptual clarity. The other 21 items and the path diagram concerning these items' factor loads were presented in Figure 1. The factor loads of the items left in the scale varied between 0.40 and 0.70. While the first, second, third, and fifth factors consisted of four items each, only the fourth factor consisted of five items.

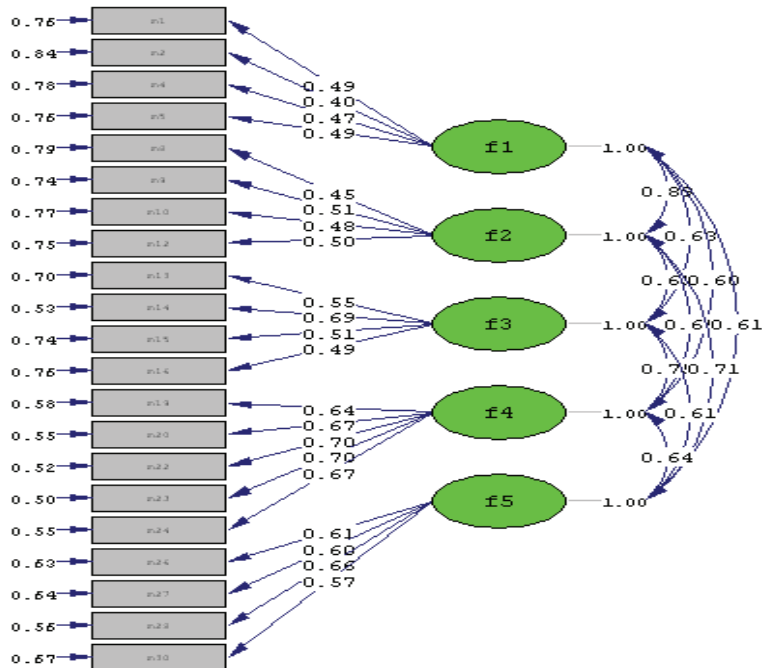


Figure 1. The factor loads of the items

A CFA was employed in order to test the factor structure that shows the Constructivist Learning Environment Scale. Firstly, for a model with 5 factors set in the original scale, goodness of fit (GOF) statistics were figured out. As a result of the analysis, $\chi^2 = 381.64$; ($sd=179$, $p < .01$); ($\chi^2/sd=2.13$, SRMR (Standardized Root Mean-Square Residual)=0.030, GFI (Goodness-of-Fit Index)=0.97, AGFI (Adjusted Goodness-of-Fit Index)=0.96, RMSEA (Root Mean Square Error of Approximation)=0.032, CFI (Comparative Fit Index)=0.98, NNFI (Non-Normed Fit Index)=0.80 pointed out that the model fit into the expected level. As a result, it was established through fit indices of confirmatory factor analysis that the Turkish version CLES comprised 21 items and five factors and this model was found to be appropriate theoretically and statistically.

Table 1. ...Standardized Lambda-X, T And R^2 values of CLES items

Factors and Items	L	t	R^2	
F1	M1	0.49	14.15	0.24
	M2	0.40	11.57	0.16
	M4	0.47	13.57	0.22
	M5	0.49	14.19	0.24
F2	M8	0.45	13.46	0.21
	M9	0.51	15.24	0.26
	M10	0.48	14.29	0.23
	M12	0.50	14.96	0.25
F3	M13	0.55	17.05	0.30
	M14	0.69	21.77	0.47
	M15	0.51	15.49	0.26
	M16	0.49	14.82	0.24
F4	M19	0.64	22.07	0.42
	M20	0.67	23.35	0.45
	M22	0.70	24.33	0.48
	M23	0.70	24.77	0.50
F5	M24	0.67	23.36	0.45
	M26	0.61	19.33	0.37
	M27	0.60	18.97	0.36
	M28	0.66	21.27	0.44
	M30	0.57	17.92	0.33

Table 1 shows standardized *Lambda-x* values, *t* values and multiple correlation values of items gained through CFA. All of the values gained are significant for $p < .05$. When *Lambda-x* values displaying factor loads are examined, it can be seen that factor loads vary between 0.40 and 0.70. These values indicate that factor loads of the items are at satisfactory level.

Table 2 shows arithmetic mean, standard deviation and Pearson correlation matrix for the points received by the sampled group from the five subscales. These correlation values show that the highest correlation value is between F3 and F4.

Table 2. Pearson Correlation Coefficients between subscales' points and their descriptive statistics

Factors	\bar{X}	S	Pearson Coefficients				
			1	2	3	4	5
F1	16.2724	2.77039	-	0.476*	0.355*	0.393*	0.361*
F2	16.2989	2.92374		-	0.381*	0.441*	0.441*
F3	14.0941	3.87326			-	0.538*	0.412*
F4	18.0219	4.89856				-	0.487*
F5	15.6042	3.50997					-
Total	80.2916	13.38821	0.652*	0.704*	0.751*	0.827*	0.731*

* $p < .01$

4. Discussion

After the confirmatory factor analysis the Turkish version of constructivist learning environment scale was consisted of 21 items and five sub factors. Some of the adaptation studies in other languages and cultures kept the factor structures of the scale unchanged but that there were some changes in the number of items (Aldridge, Fraser, Taylor and Chen, 2000; Johnson & McClure, 2004; Kim, Fisher & Fraser, 1999; Lee & Taylor, 2001). Finding low factor values and therefore removing some of the items from the scale could be attributed to cultural differences. Aldridge, Fraser, Taylor and Chen (2000), adapted the scale to Taiwanese in their study. The findings from this study, which contained one-to-one interviews with students in addition to scale adaptation, revealed that because of the cultural structure of their country Taiwanese students avoided criticizing the teacher and that they tended to listen to what the teacher told them instead of undertaking the responsibility for learning. Similarly, in their study with science teachers in the USA, Johnson and McClure (2004) came up with a scale consisting of 20 items. It could be suggested in conclusion that the structure consisting of five factors and 21 items in this study is consistent with the studies in other countries.

5. Conclusion and Recommendation

A confirmatory factor analysis was carried out in adapting the constructivist learning environment scale into Turkish. The scale was performed on 1094 students chosen randomly from primary schools in Eskisehir and Istanbul city centers. As a result of the analysis, it was determined that the five-factor structure of the original scale consisting of 30 items and five subscales was kept the same but that the number of items was reduced to 21. When tested with CFA, the calculation with analysis is $\chi^2/df = 2.13$. Being smaller than 3 of this rate shows that the model is acceptable (Ayyıldız ve Cengiz, 2006). RMSEA=0.032 and RMR=0.046. Being close to 0 of these values and even the values which are equal to or smaller than 0.05 show a very good fit (Tezcan, 2008). In the model, it is GFI=0.97 and AGFI=0.96. The cases that GFI value is over 0.85 and AGFI value is over 0.80 are acceptable levels for the fit (Cole, 1987; March, Balla & McDonald, 1988). With regard to GFI and AGFI values, there is an acceptable accordance. CFI=0.98 NNFI=0.98 which are the increasing GOF indexes are being close to 1, it can be said that there is an acceptable fit (Şehribanoğlu, 2005).

Even thought, CFA results which are conducted in Eskisehir and Istanbul sampling for fifth grade students are consistent with the real data, it can be said that it's necessary to be improved in the adaptation processing. That's why; the researches have to be done on bigger sampling size in order to determine the norms of the scale in Turkish culture regarding in Turkey population.

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