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DEVELOPMENT AND VALIDATION OF PHYSICAL CLASSROOM LEARNING ENVIRONMENT INSTRUMENT (PCLEI) FOR SECONDARY SCHOOL IN MALAYSIA

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Abstract

The purpose of this study was to develop and validate a new learning environment instrument used to measure the physical learning environment in secondary school's classroom in Malaysia. The Physical Classroom Learning Environment Instrument (PCLEI) was developed by using a three stages approach, field-tested with 900 students and then validated. The PLCEI has 66 items allocated to six constructs: (1) furniture; (2) facilities; (3) space; (4) lighting; (5) air quality; (6) color. Each construct has a factor loading at least 0.40 and alpha reliability coefficient for constructs ranged from 0.83 to 0.98. The instrument will inform us on existing physical learning environment in secondary school's classroom. Further effective way can be planned to overcome the existing gaps.

Keywords: Instrument, learning environment, physical aspect

INTRODUCTION

Physical component is one of main aspect in the learning environment. It encompasses the classroom, teaching and learning materials and facilities inside and outside the classroom (Che Nidzam et al., 2010). Mok (2009) also stated that school physical factors include the physical arrangement of the classroom and the school.

Good physical environment can enhance student's focus in classroom, learning and interaction, thus improving student achievement over time (Baek & Choi, 2002; Waldrip & Fisher, 2003). The classrooms physical environment can give positive impact on the effectiveness of teaching and learning process as it can make that process occurs in a comfortable and enjoyable way (Veal & Jackson, 2005; Ahmad Fauzi, 2005). In addition, the physical environment plays an important role in ensuring students safety, reducing the risk of accidental injury and subsequently contributing to attitude, well-being, happiness and creativity of students (Australian Children's Education & Care Quality Authority, 2012). A previous study also shows that the physical environment has an important role in teaching and learning process as it can enhance students involvement in activities that promote a better understanding of concepts, problem solving abilities and attitudes towards learning (Mohd Hairy et al., 2012).

However in Malaysia, study on the physical environment, especially in the classroom is still in the early stages. According to Lilia (2009), only few studies have been done on the physical characteristics in the classroom that may be able to affect the learning environment experienced by the students. Ahmad Fauzi (2005) also stated that the study of the classroom physical aspects is not popular among researchers and scarce. The factor that was found to

contribute in lack of studies conducted on the physical environment in the classroom is due to unfixed and inappropriate instruments to be applied in the study. Therefore, there is a need to build an instrument that has a good validity and reliability in evaluating the physical environment in the classroom in secondary schools in Malaysia. Through this study, the researchers want to develop and validate an instrument that will provide information to the authorities about the state of the physical environment in the classroom at school.

RESEARCH METHOD

This study was conducted using quantitative method. All the data were collected by using questionnaire. The target population for this research was the Malaysian's secondary school students which is in their Form Four. The sample of respondents consisted of 900 students and fortunately this value was exceed as suggested. Krejcie and Morgan (1970) suggested 384 of respondents were needed as sample for one million students.

The development of the PCLEI used a three-stages approach. These steps were used in the study by Walker and Fraser (2005). Stage one include the identification of salient physical learning environment construct, stage two involve writing individuals items within the constructs and preliminary study while stage three perform the field testing.

Stage one consist four steps which are reviewing literature related to physical learning environment in the classroom, reviewing previously developed learning environment instruments for constructs that could be modified for the PCLEI, conducting a discussions with experienced teachers and lecturers to obtain their opinions and lastly classifying newly developed constructs and developing a set of preliminary constructs. Stage two involving three steps which are both adapting items used in previously validated learning environment questionnaires and developing new items for the constructs identified, subjecting the entire set of items to face validation by seven panel of experts and pilot testing. Meanwhile, stage three including two steps which are field testing the draft instrument with a large sample from the target population and conducting the factorial analysis.

Overall, PCLEI consist of six constructs including furniture, facilities, space, lighting, indoor air quality and color. The constructs and examples of items in the PCLEI were described in Table 1 below.

Table 1: Physical Classroom Learning Environment Instrument (PCLEI)

Scale	Description	Item per scale	Sample Item
Furniture	Extent to which the furniture's in the classroom are suitable	31	The tables in the classroom are safe to be used
Facilities	Extent to which the classroom is supported by the suitable facilities	56	The classroom is occupied by suitable facilities which can help learning process
Space	Extent to which the learning space in the classroom is suitable	16	There is spacious learning space for the students in the classroom
Lighting	Extent to which the quality of lighting in the classroom is suitable	11	The lighting level can be control by using separate switch

Indoor air quality	Extent to which the indoor air quality in the classroom is suitable	20	Enough window present in the classroom to increase the efficiency of air flow
Color	Extent to which the color used in the classroom is suitable	12	There is suitable color in the classroom

RESULT AND DISCUSSION

Content validity

After the constructs and items was developed, the entire instrument was sent to seven experts who have expertise in the field of education and learning environment. The experts evaluated this instrument by using Cohen Kappa table. Table 2.0 showed the scores given by each experts for all the items in the instrument. In detailed, Expert 1 was given 0.96, 0.76 by Expert 2, 0.98 by Expert 3, 0.93 by Expert 4, 0.87 by Expert 5, 0.88 by Expert 6 and 0.99 by Expert 7. The highest score was given by Expert 7 (0.99) while the lowest value given by Expert 2 (0.76). According to the 'rule of thumb', this range is considered to be good to very good (Cohen,1968).

Table 2.0: Content validity of the experts based on Cohen Kappa's value

EXPERT	SCORE
Expert 1	0.96
Expert 2	0.76
Expert 3	0.98
Expert 4	0.93
Expert 5	0.87
Expert 6	0.88
Expert 7	0.99

Reliability

In the development of PCLEI, each construct was assessed for internal consistency. This analysis was conducted to serve two purposes which are to refine the PCLEI constructs and to provide evidence regarding reliability and validity of the refined constructs (Walker and Fraser, 2005). Then, items which not highly correlated with their respective construct were removed and data were reanalyzed until all the items with lowest item-scale correlations were removed and the alpha coefficient was maximized. Analysis of the refined data set provided evidence to support the overall reliability of the refined constructs.

Table 3.0 showed the alpha reliability of each refined PCLEI constructs from the pilot testing of 100 students. The internal consistency reliability (coefficient alpha) range from 0.84 to 0.98 for the six PCLEI constructs. In detail, the Cronbach's alpha were 0.90 for the furniture, 0.97 for facilities, 0.98 for space, 0.84 for lighting, 0.89 for indoor air quality and 0.91 for colour. Using a generally-applied 'rule of thumb', this range is considered to be good to very good (George and Mallery, 2001), since the closer the alpha is to 1, the greater the internal consistency of the items. The alpha for the constructs of furniture (0.90), facilities (0.97), space (0.98) and color (0.91) were considered very good while the scale of lighting (0.84) and indoor air quality (0.89) were deemed good.

Table 3.0: Scale Reliability Using Cronbach's Alpha Coefficient for PCLEI

Scale	Number of items	α Reliability
Furniture	21	0.90
Facilities	28	0.97
Space	16	0.98
Lighting	11	0.84
Indoor air quality	20	0.89
Color	12	0.91

Factorial Analysis

Factorial analysis was conducted in order to measure the validity of the construct in the PCLEI. Factor analysis also provided information about whether items within a given construct are measuring that construct and no other construct. According to Kamisah et al. (2006) there are various methods or approach that can be used in the suggested the validity of an instrument. The methods can be classified into three main categories, namely the validity of content, criteria and constructs. Then, after considering the purpose of items construction that has produced, researcher would like to focus on construct validity. This is based on the continuation of the study by Nunally (1967) and Messick (1980) in Kamisah et al. (2006) stated that the construct validity was more justified than other procedures in the measurement of a test.

Construct validity was investigated by using principal component factor analysis with Varimax rotation and Kaiser normalization. Prior to factor analysis, *Bartlett's Test of Sphericity*, which provide information whether there is a relation between *Kaiser-Meyer-Olkin* (KMO) coefficient and variables, was applied to test whether the data were suitable for factor analysis. The sample should be adequate since the size of the sample affects the results of factor analysis. Pallant (2001) suggested that KMO should be greater than 0.60 so factor analysis could be applied on the data. In this study, KMO value was 0.95, which fell in intended range. Besides, the result of *Bartlett's Test of Sphericity* was significant [Barlet Test=44140.990, df=2145, (p<.000)]. The result of KMO and *Bartlett's Test of Sphericity* indicated that the adequate sample size was provided in this study and factor analysis could be carried out on these data.

In this study, six constructs were originally developed for the PCLEI field test and, after factor analysis, the same six constructs remained; furniture, facilities, space, lighting, indoor air quality and color. This construct could be remained based on the result of Eigen values which greater than 1.0. Kaiser criterion which recommends that researchers select constructs with Eigen values greater than 1.0. Besides, this six constructs explained 56.29% of the total variance. For social sciences, variances rates between 40% and 60% are accepted adequate (Kutluca et al., 2010).

In the factor analysis, items with load factor greater than 0.40 were taken. Thus, eighty items that have load factor below 0.40 were removed. Finally, this instrument ended up with 66 items. The first construct, furniture had 14 items and the load values of these items varied between 0.48 and 0.65. The second construct, facilities had 6 items and the load values varied between 0.93 and 0.96. The third construct, space had 16 items and varied between 0.57 and 0.74. The fourth construct, lighting had 6 items and load values varied between 0.47 and 0.65. The fifth construct, indoor air quality had 12 items and the load values varied between 0.43 and 0.75. Finally the last construct, color had 12 items and the load values varied between 0.55 and 0.78. Table 4.0 presents items of each construct and their factor loads.

Table 4.0 Factor Loadings For A Refined Version of the PCLEI

Factor Loading						
Item	Furniture	Facilities	Space	Lighting	Indoor Air Quality	Color
1	.524					
2	.596					
3	.624					
4	.639					
5	.635					
6	.593					
7	.646					
8	.509					
9	.632					
10	.481					
11	.538			.		
12	.571					
13	.481					
14	.497					
15		.956				
16		.954				
17		.954				
18		.943				
19		.948				
20		.931				
21			.698			
22			.737			
23			.726			
24			.722			
25			.573			
26			.679			
27			.646			
28			.676			
29			.600			
30			.589			
31			.592			
32			.705			
33			.704			
34			.734			
35			.700			
36			.687			
37				.468		

38				.596		
39				.474		
40				.624		
41				.647		
42				468		
43					.630	
44					.425	
45					.575	
46					.565	
47					.592	
48					.746	
49					.635	
50					.702	
51					.663	
52					.618	
53					.699	
54					.691	
55						.578
56						.631
57						.738
58						.771
59						.778
60						.755
61						.721
62						.645
63						.618
64						.548
65						.555
66						.572

The latest version of PCLEI consist of 6 construct and 66 items. Based on the analysis conducted, this instrument found to have a high reliability and also a good construct validity which could be used in the study of the classroom physical learning environment. Besides, PCLEI also had its own uniqueness as it contained the physical aspects of the learning environment that might affect the student learning. These physical aspects were chosen based on the results of previous studies and discussion with experienced lecturer and teachers. PCLEI also had the advantage of being easily administered as well as answered by the respondents as it used a simple word and easy to be understood. In addition, it's also economy of use in terms of saving time and cost.

PCELI is an addition to existing instruments, particularly to evaluate the physical facilities in the classroom learning environment. The PCLEI could be adapted and used for various kinds of respondents and for different environments depending on the needs and creativity of researchers. However, extra care needs to be taken especially about verification part since this instrument was designed for the classroom learning environment in the secondary school and only involved students as respondents. Further research is needed to strengthen this instrument such as involving more students in the rural area as respondents.

CONCLUSION AND SUGGESTION

This paper has reported in detailed the development and validation procedure taken in order to design the Physical Classroom Learning Environment Instrument (PCLEI) to access the physical classroom learning environment in secondary school in Malaysia. This required several steps that needed to be followed in order to achieve high reliability and validity of this instrument. The development of this instrument was an addition to the physical classroom learning environment study. The finding of this study confirmed the validity and reliability of the PCLEI showing that it is an useful instrument for its evaluation.

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