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Investigation of Constructivist Learning Enviroments and Educational Facility in Science Classrooms

Kajian Pengintegrasian Persekitaran Pembelajaran Konstruktivis dan Kemudahan Pendidikan dalam Bilik Darjah Sains

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Abstract

The aims of this research are to investigate the extent of the constructivist learning environment integration in science classrooms and students' perceptions of their actual and preferred learning environments in science learning. Actual and preferred form of Constructivist Learning Environment Survey (CLES) and Learning Environment Assessment (LEA) were used in this research. The instruments were administered to 150 Form Four science students from 3 schools in Bidor, Perak. The data were analysed quantitatively for the research questions. The result showed that students agreed to most of the scales in actual form of CLES except the scale for Shared Control in which they were not invited to share teacher's control in planning learning environment. T-test showed that students tended to prefer more constructivist learning environment than the actual learning environment ($p<0.05$). Besides, the result showed that subsection Academic Learning Space in LEA was at the level of minimal adequacy whereas subsection Interior Environment showed the level of moderate adequacy. The finding suggested that science teachers should implement the constructivist approach and improve their practice based on students' preference of learning environment to improve students' performances. Also, educational facilities were suggested to be assessed to ensure the success of the integration of constructivist learning environment in the science classrooms.

Keywords constructivist learning environment, science classrooms, educational facilities, students' perceptions

Abstrak

Tujuan kajian ini adalah untuk menyiasat sejauh mana pengintegrasian persekitaran pembelajaran konstruktivis dalam bilik darjah sains dan mengenalpasti persepsi pelajar terhadap persekitaran pembelajaran sains sebenar dan yang diinginkan. *Constructivist Learning Environment Survey* (CLES) (sebenar dan diinginkan) dan *Learning Environment Assessment* (LEA) digunakan dalam kajian ini. Instrumen ini ditadbir kepada 150 orang pelajar Tingkatan Empat di tiga buah sekolah di daerah Bidor, Perak. Data dianalisis secara kuantitatif bagi menjawab persoalan kajian. Hasil kajian menunjukkann pelajar bersetuju dengan kebanyakkan skala dalam CLES kecuali skala bagi perkongsian kawalan yang mana mereka tidak diajak untuk berkongsi kawalan dengan guru dalam merancang persekitaran

pembelajaran. Hasil ujian-t menunjukkan pelajar inginkan pesekitaran pembelajaran konstruktivis yang lebih baik berbanding persekitaran sebenar ($p<0.05$). Selain daripada itu, hasil kajian juga menunjukkan bahagian ruang pembelajaran akademik dalam LEA berada pada tahap kecukupan yang minimal manakala bahagian persekitaran dalaman berada pada tahap kecukupan yang sederhana. Dapatan ini menunjukkan guru sains seharusnya mengamalkan pendekatan konstruktivis dan meningkatkan amalan pengajaran berdasarkan keperluan persekitaran pembelajaran pelajar untuk meningkatkan pencapaian pelajar. Selain daripada itu kemudahan pendidikan perlu dinilai bagi memastikan kejayaan pengintegrasian persekitaran pembelajaran konstruktivis dalam bilik darjah sains.

Kata kunci persekitaran pembelajaran konstruktivis, bilik darjah sains, kemudahan pendidikan, persepsi pelajar

INTRODUCTION

Learning may occur in a variety of locations such as school, classroom, laboratory, field and so on. Learning environment not only refers to physical location, it encompasses learning resources and technology, means of teaching, modes of learning, and connections to societal and global contexts (Warger, EduServe & Dobbin, 2009).

Today, learning approaches in educational settings are changing. Educational psychologists believe that social activities are extremely important in the lives of children and adolescents (Laurel & Lindgren, 1975). Additionally, learning environment in educational discourse is closely related to the emerging use of information and communication technologies, together with the constructivist concept of knowledge and learning (Mononen-Aaltonen, 1998). The former traditional teacher-centred model is being replaced with student-centred approach which emphasizes the construction of knowledge through experience, active and collaborative learning, with the integration of technology.

Student-centred approach in knowledge acquisition is the major criteria which focused on constructivism. According to Duit (1996), constructivist view is primarily concerned with conceptualizing knowledge and knowledge acquisition. The constructivist learning environment designs are student-centred, collaborative, cooperative, and experiential. Four main facets of the knowledge view include active construction on the basis of the already existing conceptions, tentative construction, viability and social construction. In short, students have to construct their new knowledge by themselves from existing knowledge as well as experience in nature, where the knowledge needs to be viable for individual. In constructivism, the vital role of social development in learning enables students to communicate and share their knowledge in order to achieve their learning goals together.

Constructivism may occur if there are a variety of spaces for group activities which promote social integration in school. Students' interaction is fostered when there is adequate space in classroom for realignment of sitting during study and discussion. Also, educational facility needs to provide for the use of a number of different kinds of teaching devices in the instructional materials and information resources centre (Castaldi, 1987). If there is no adequate space and insufficient school facilities, the conducive constructivist learning environment will not be formed. In other words, educational effectiveness of the school facility is believed to correlate with the integration of constructivist approach in teaching and learning.

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Although constructivist learning environment is always promoted since the reformation of the Science curriculum, the extent of constructivist learning environment integration in Malaysian secondary school remains unknown. There is no statistic that really shows that constructivism is practiced by science teachers in every school. Additionally, the curriculum reformation does not guarantee that every student is able to accept and practise the concept of constructivism in their learning. Thus, it is a need to investigate the extent of constructivism integration in school including students' preference of learning environment and educational facilities which enhances science learning. Furthermore, there is only minimal research attention on constructivist learning environment directed in Malaysia. The researches mostly focused on the use of technology to create constructivist learning environment and the effect of learning environment on students' achievement (Sultan, Woods & Koo Ah Choo, 2011). However, not many studies have been conducted to examine educational facilities in science classroom and its relationship with integration constructivism learning environment in Science based on students' perception. Hence, in this paper, the researcher focused on the assessment of educational facilities, investigation of the extent of constructivist approach integration and students' preferred learning environment in secondary school

OBJECTIVES

1. To investigate the extent of the intergration of constructivist learning environment in science classrooms
2. To investigate students' perceptions of their actual and preferred learning environments through constructivist views.
3. To assess educational facilities in schools

METHODOLOGY

Quantitative approach was utilized as a survey data collection method to answer the research questions. This research was designed to get responses from the Form Four Science students about their perceptions on actual and preferred constructivist learning environment and educational facilities. A total sample of 150 Form Four Science students were randomly chosen from secondary schools in Bidor, Perak, Malaysia. Since there were only three secondary schools in Bidor district, Perak, the population of Form Four Science students was about 195. According to Krejcie & Morgan (1970), there was an efficient method of determining the sample size needed to represent a given population by using a formula. For a population of 195, the required sample size should not be less than 127.

Two questionnaires were chosen in this research. The first questionnaire was Constructivist Learning Environment Survey (CLES) in both actual and preferred form which investigated students' perceptions of their learning environments through constructivist view. The second questionnaire was Learning Environment Assessment (LEA) which assessed the quality and educational effectiveness of the school facility

CLES (Taylor, Fraser & Fisher, 1997) measures the students' perceptions of the frequency of occurrence of five key dimensions of a critical constructivist learning environment: Personal Relevance, Student Negotiation, Shared Control, Critical Voice

and Uncertainty (Table 1). It contains 30 items with five point response scales of "almost always, often, sometimes, seldom, almost never" which will be used in both actual and preferred forms of CLES. In this research, all the 30 items were derived from the CLES by Taylor et al. (1997) in both actual and preferred form. Actual form assessed the current learning environment of the classroom whereas the preferred form concerned with goals and value orientations and measured perceptions of the learning environment ideally liked or preferred. Although item wording was similar for both actual and preferred forms, the instructions for answering each item were somewhat different.

Table 1 Scales description of CLES

Scales	Descriptions	Item Sample (Actual form)	Item Sample (Preferred form)
Personal Relevance	extent to which teachers relate science to students' out-of-school experiences	In this class, I learn about the world outside of school.	In this class, I wish that I learn about the world outside of school.
Uncertainty	extent to which opportunities are provided for students to experience scientific knowledge as arising from theory dependent inquiry, involving human experience and values, evolving and non-foundational, and culturally and socially determined	In this class, I learn how science has changed over time.	In this class, I wish that I learn how science has changed over time.
Critical Voice	extent to which a social climate has been established in which students feel that it is legitimate and beneficial to question the teacher's pedagogical plans and methods and to express concerns about any impediments to their learning	In this class, it's OK for me to ask the teacher "why do I have to learn this?"	In this class, I wish that it's OK for me to ask the teacher "why do I have to learn this?"
Shared Control	extent to which students are invited to share with the teacher control of the learning environment, including the articulation of their own learning goals, design and management of their learning activities and determining and applying assessment criteria	In this class, I help the teacher to plan what I am going to learn.	In this class, I wish that I could help the teacher to plan what I am going to learn.

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Table 1 (*Cont...*)

Scales	Descriptions	Item Sample (Actual form)	Item Sample (Preferred form)
Student Negotiation	extent to which opportunities exist for students to explain and justify to other students their newly developing ideas and to listen and reflect on the viability of other students' ideas	In this class, I ask other students to explain their ideas.	In this class, I wish that I could ask other students to explain their ideas.

All scale descriptions were taken from Taylor et al. (1997).

Teaching and Learning Environment Assessment (TLEA) (O'Neill, 2000) accesses the quality and educational effectiveness of the school facility. It contains 82 questions which are divided into two sections. The first section of the instrument is Educational Adequacy, which comprises Academic Learning Space, Specialized Learning Space, Support Space and Community or Parent Space; and the second section is Environment for Education, which consists of Exterior Environment, Interior Environment, and Visual Reinforcements. In this research, Learning Environment Assessment (LEA) which was adapted from the original TLEA had been utilized. There were two subsections in LEA - Academic Learning Space from section Educational Adequacy; and Interior Environment from section Environment for Education (Table 2). A total of 31 questions were given to students sample to access the quality and educational effectiveness of the school facility in students' perception. Four response scales of "strongly agree", "agree", "disagree", and "strongly disagree" were developed for ranking indication.

Table 2 Subsection description of LEA

Subsection	Descriptions	Item Sample
Academic Learning Space	Access classroom space, material storage, technological equipment and facility in both classroom and school	- Classroom space permits arrangement for small group activity. - Classrooms have logical, well-designed, integrated technology systems.
Interior Environment	Access physical conditions of classroom, furniture and maintenance of school facility to enhance students' learning.	- Colour schemes, building materials and décor provide an impetus to learning - Condition of your facility is excellent both cosmetically and structurally.

The validity of LEA and CLES in both actual and preferred form was carried by showing to expert in educational research in Universiti Pendidikan Sultan Idris (UPSI). Adjustments had been made based on the expert's suggestions. The questionnaires were administered to 39 students to get its reliability before the research was carried out. Ideally, Cronbach alpha coefficient above of 0.70 will be considered acceptable as suggested by Pallant (2007). The

present study yielded the alpha-reliability to be 0.87 (actual form of CLES), 0.89 (preferred form of CLES) and 0.87 (LEA), indicating high reliability (Table 3).

Table 3 Internal consistency reliability (Cronbach alpha coefficient) for CLES and LEA

Instrument	Alpha Reliability
CLES Actual	0.87
CLES Preferred	0.89
LEA	0.87

RESULTS AND DISCUSSION

Integration of constructivist learning environment in science classrooms

In order to investigate to what extent was the constructivist learning environment integrated in secondary school's Science learning and students' preference learning environment in Bidor district, descriptive analysis based on actual and preferred form of CLES was conducted.

Table 4 Average mean of actual CLES

Scale	Actual	
	Mean	Standard deviation
Personal Relevance	3.11	0.71
Uncertainty	3.27	0.74
Critical Voice	3.01	0.90
Shared Control	2.63	1.04
Student Negotiation	3.35	0.93

Average mean of four scales in CLES actual form reported mean above 3 (Table 4). The scales were Personal Relevance (3.11), Uncertainty (3.27), Critical Voice (3.01) and Student Negotiation (3.35) in which the students in Bidor district agree that the four scales of CLES had been practiced in their science learning. It indicated that students in Bidor district agreed that they were given opportunities to learn Science knowledge from the world outside of school and different determinant, express opinions, explain ideas as well as problem solution between one another.

Scale Shared Control had reported mean of 2.63 where students disagree that they were invited to share with the teacher control of learning environment. This may be due to teachers having to finish syllabus in limited time given. Rush for time kills relevance (1998) also pointed out this matter in that teachers need to complete the syllabus in a limited time. In the Malaysian curriculum, there are five lessons for science subject and four lessons for biology subject weekly. It indicated that teachers have to finish the entire syllabus in fewer lesson weekly including laboratory session. Exam-based education system in Malaysia requires students to focus more on books to secure perfect scores in examination. Although Malaysian education syllabus had been simplified (Hornbill Unleashed, 2012),

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still, teachers lack of time to finish the syllabus as planned at the same time they have to discuss with students over exercises given, relate out-of-school experience with science and encourage active learning. Time constraints do not allow students to practise control over what they learn and teachers have no freedom to share control with the students in designing learning activities.

Comparison of students' actual and preferred learning environment

The average mean of actual and preferred CLES were analysed and shown in Table 5.

Table 5 Average mean of actual and preferred CLES

Scale	Actual		Preferred	
	Mean	Standard deviation	Mean	Standard deviation
Personal Relevance	3.11	0.71	4.06	0.74
Uncertainty	3.27	0.74	3.69	0.70
Critical Voice	3.01	0.90	3.75	0.82
Shared Control	2.63	1.04	3.67	0.88
Student Negotiation	3.35	0.93	4.16	0.75

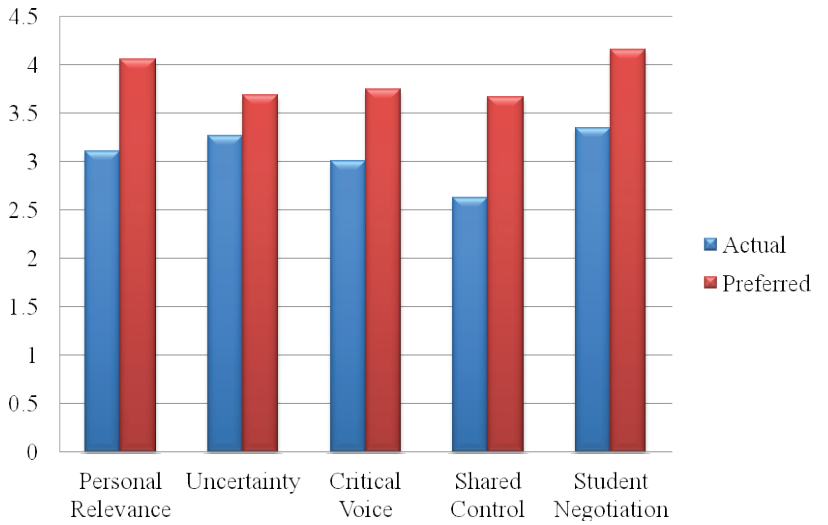

Figure 1 Average item mean for students' actual and preferred CLES

In preferred form of CLES, all the five scales showed average item mean above 3 (Table 5). The five scales were personal relevance (4.06), uncertainty (3.69), critical voice (3.75), shared control (3.67) and student negotiation (4.16). The result showed that students had more positive responses for each scale in CLES preferred form compared to CLES actual form, indicating that they preferred more positive and active learning environment than the actual learning environment they had experienced now (Figure 1).

Table 6 Difference between actual and preferred form of CLES

Pair	Mean	Standard Deviation	t	df	Sig. (2-tailed)
CLES Actual CLES Preferred	-0.79	0.80	-12.05	149	.000

T test was conducted to investigate the difference between students' actual and preferred learning environment (Table 6). The result showed that there was a statistically significant difference ($p<0.05$) between actual and preferred form of CLES. It meant that students would prefer a much more constructivist learning environment in which the actual learning environment did not adapt to their preferences. They wish that they had more opportunities to relate science with the real world, take roles in decision making process, question what is going on in the lesson freely, communicate in the classroom and experience the formulation of scientific knowledge. The result tended to support the findings of previous studies that students preferred a more positive learning environment than they perceived as being present (Ozkal, Tekkaya & Cakiroglu, 2009; Kim Heui Baik, Fisher & Fraser, 1999; Aldridge, Fraser, Taylor & Chen Chung Chih., 2000; Puacharearn & Fisher, 2007).

Adequacy of educational facilities in schools

In order to investigate educational facilities in schools in Bidor district, descriptive analysis had been conducted. The mean of subsection academic learning space and subsection interior environment was tabulated in Table 7.

Table 7 Average mean of LEA

Subsection	Mean	Standard Deviation	Level
Academic Learning Space	2.48	0.53	Minimal adequacy
Interior Environment	2.65	0.56	Moderate adequacy

The average item mean of subsection academic learning space reported 2.48 which indicated the level of minimal adequacy and subsection interior environment reported an average item mean of 2.65 which indicated level of moderate adequacy.

In Academic Learning Space, items related to classroom space and material storage showed the level of moderate adequacy, indicating that there were adequate spaces in the classroom for students' activities and material storage was adequate in which both teachers and students may easily access to the learning materials. however, items that related to technological equipment in classroom showed level of minimal adequacy. It indicated that science classroom in Bidor were minimal adequate with computers, telephones and network system although ICT was believed to guide students and lead development in 21st century learning environment (Vygotsky, 1978 as cited in Lippman, 2010).

The interior environment which comprised of colour schemes, floor plan, lighting system, roof and arrangement of classroom furniture showed level of moderate adequacy in Bidor schools. However, there were minimal adequacy of acoustical treatment of ceilings, walls and floor. It may be due to high cost of acoustic products and piecemeal renovation.

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Also, the condition of classroom furniture and school facilities was unsound ascribable to defer or lack of school facilities' maintenance. The costs of managing school facilities have historically received much less attention than facility planning (Lackney & Picus, 2005).

CONCLUSION

Constructivist learning environment has started to be practised in schools in Bidor, Perak. Although it is not fully integrated, it is a good beginning where teachers have given out some of their traditional pedagogy plan and accept constructivism in teaching and learning activities. The finding showed that there was significant difference between students' actual and preferred learning environment. Students in Bidor district perceived that their actual science learning environments were less constructivist compared to what they preferred. It suggests that science teachers should implement constructivist approach and improve their practice based on students' preference learning environment to improve students' performance. Besides, present study revealed that educational facilities in schools in Bidor district showed minimal adequacy in subsection Academic Learning Space and moderate adequacy in subsection Interior Environment. In addition, the finding showed that there is correlation between educational facilities and constructivist learning environment. Educational facilities, physical learning environment and technical specifications are needed to be considered in order to plan and construct effective constructivist learning environment in school. The process towards constructivism takes time as there are many aspects need to be considered.

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