A Constructivist Approach for Digital Learning: Malaysian Schools Case Study

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ABSTRACT

The purpose of this study was to investigate the influences of Constructivist Learning Environments (CLEs) through the use of laptops supported within 1:1 e-learning education in Malaysian schools. The main objectives of this study were to investigate (a) different possible gaps between constructivist theory and classroom practices in Malaysian schools, (b) success, if any, of the classroom students who would undertake Classmate PC (CMPC) classroom putting while into practice a constructivist approach to learning, and (c) develop a conceptual framework model based on students' communication in a constructivist learning environment. Yet, (d) there is a strong need to address Constructivist Learning Environments (CLEs) practices on local Malaysian settings. A modified Constructivist eLearning Environment Questionnaire (CLEQ) survey used in this study was multiply regressed against student Perceived Learning Outcomes (PRCVD). Findings revealed different aspects of students' learning outcomes and enforcement to use creative thinking in building students' knowledge within constructivism learning context.

Keywords

Constructivist, learning, environments, classroom, process

Introduction

Recent research concerning classroom learning environment has focused on assessment and improvement of learning within the context of Constructivist Learning Environments (CLEs) (Aldridge, Barry, Peter, & Chung-Chih, 2000; Taylor & Cox, 1997; Taylor, Fraser, & White, 1994). A constructivist approach views knowledge as constructed by and embedded in each learner, not something "outside" a learner (Lund & Tannehill, 2010). Learning is not only an "idiosyncratic experience", but it is influenced by social and interaction process. In this study, the researcher attempted to measure the factors of CLEs that might have influenced the "communication between students" and "their learning outcomes". Measure of the factors influencing CLEs in this study was modified from the original version of the study conducted by (Taylor, Fraser, & White, 1994) to suit Malaysian students' age and maturity based on their educational level (age 8-13 years). This study provides an instrument validation for assessing students' preferences toward CLEs and identifies and measures students' perception from five different factors pre-identified from previous research.

Background of the study, ICT initiative in Malaysia school education

The concept of Information & Communication technology (ICT) comes as a part of the Malaysian Information Technology (IT) agenda that exposes all field players starting from students, teachers, administrators and parents to fully utilize IT in every aspect of education at the administrative and classroom levels. School classrooms in this program feature such technology-enablers as laptops personal computers, multimedia computer laboratories, video conferencing systems and high-speed Internet connections. This is done by providing each student with a laptop, providing teacher training to promote project based learning as well as principal training on ICT implementation and development plan.

Related literature

The below sections reviewed related literature to the conceptual framework of the study (Figure 1). Students' perceived e-learning outcomes is mediated by a complex interaction of variables which are: (a) E-Learning resources that needed to link pedagogical curriculum and learning process in the educational environment, (b) a contribution of CLEs dimensions expected to expose students' different activities and engagement in meaningful interactions, (c) possible contribution of different barriers or dilemmas towards integrating CLE such as conceptual, pedagogical, cultural, and political barriers, and (d) students' learning outcome which derived from students' achievements and include classroom activities and performance, academic achievement, and student understanding.

A conceptual framework of this study is based on the integration of different learning theories. Constructivism states that learning takes place in contexts, and that learners form or construct much of what they learn and understand as a function of their experiences in situation (Schunk, 2000). Individuals in an e-learning environment based on constructivist views are forced to use creative thinking to build their knowledge base (Woo, et al., 2007) for meaningful interpretation and reflection of knowledge. (Fosnot, 1996; Schunk, 2008) asserts knowledge is physically constructed by learners who are involved in active learning. This active learning and authentic tasks requires occasionally minimal guidance to enhance student learning and motivation to transfer what is learned to novel problems encountered elsewhere by reducing student cognitive load during tasks (Kirschner, Sweller, & Clark, 2006). Many scholars prefer direct instructions practices in regard to constructivist-based guidance as effectiveness learning strategy (Klahr, 2005; Kolb, et al., 2007).

The constructivist paradigm views the 'context' in which learning occurs as central to the activity of learning itself, and this has proved to be a useful theory for designing and developing e-learning programs (McMahon, 2007). Contextualizing learners' existing knowledge to facilitate the process of new learning experiences is deemed crucial. As Zajda (2004) asserts, cultural and social capital is a crucial dimension in understanding educational processes and academic achievement. In addition, "different social classes maintain different or even antagonistic relations to culture, depending on the conditions in which they acquired their cultural capital and the markets in which they derive most profit from it." (p. 84). Moreover, Bennett & Desforges (1988) state that a critical factor underlying unsuccessful task implementation is a lack of alignment between a task and students' prior knowledge, interests, and motivation. It is argued that "the interpretation of knowledge is dependent upon the cultural and social context through which the knowledge is constructed." (Hung, 2001).

Conceptual framework

Figure (1) shows the conceptual framework for the study that has been developed from literature review. The interactive effects of a large number of variables or concepts and a review of appropriate contextualized methodologies have been also demonstrated. It posits that the students' perceived e-learning outcomes is mediated by a complex interaction of constructivism learning environment factors, learning environment, 1:1 e-learning resources, learning environment barriers.
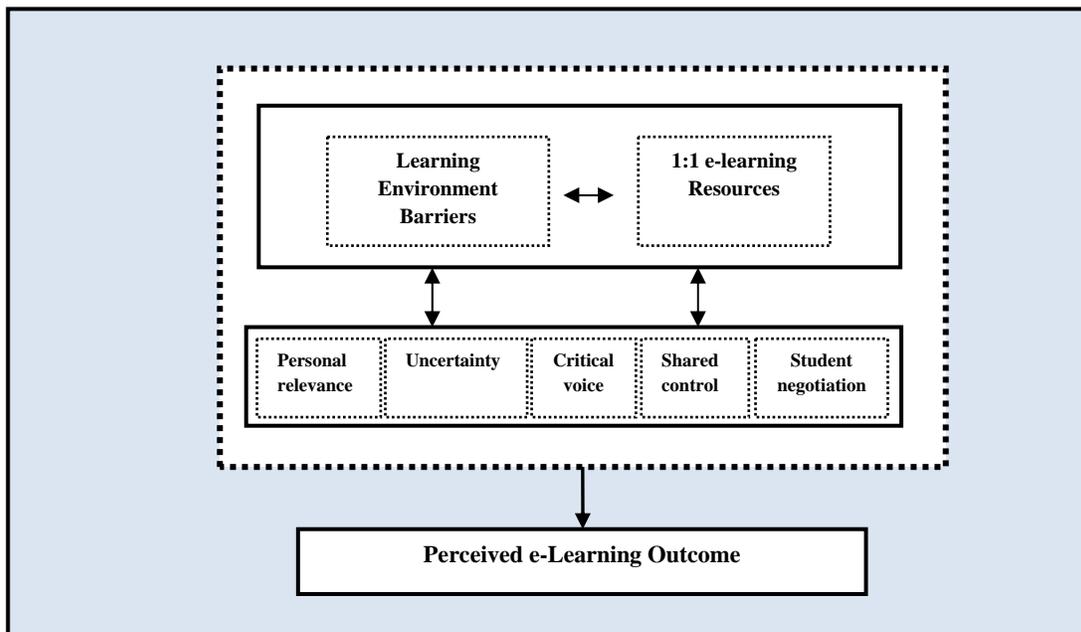

Figure 1: Operational and theoretical definitions of the main research concepts. Adapted from (Taylor, Fraser, & Fisher, 1997; Windschitl, 2002)

E-learning resources

In this study, the term 'e-learning resources' refers to learning premises and platforms that include technology enablers such as laptops, multimedia, CD-ROMs, and Internet resources. E-learning resources can give students authentic as well as up-to-date information that is not necessarily available in textbooks. Generally, e-learning resources are useful as they represent a collection of cultural and scientific knowledge accumulated over the years (Yeo, 2008). Moreover, this type of resource can be useful to students because it can foster their learning and their critical thinking, their ability to make connections between different concepts, and bridge the gap between their theoretical and practical knowledge (Palmer, 2007). Despite this, availability of resources does not lead to automatic learning improvement; in fact, productive use of resources can be difficult to achieve (Bera & Liu, 2006).

In Malaysian MOE-INTEL schools, teachers have access to an e-learning system design based on a selected pedagogical model which enables them to make use of the learning resources in a form which is appropriate to the learning goals and the particular learning styles of the students (Granic & Cukusic, 2007). Constructivist theory emphasizes the need for student-centred learning rather than teacher-centred learning (Kelsey, 2007; Young & Maxwell, 2007). Constructivist e-learning emphasizes that there are several learning activities and development programmes for students. This could be clearly in the deployment of online resources such as online information and communication resources that are useful for effective learning activity (Paurelle, 2003). The practical implication of making online resources available to students is to link students' knowledge to other useful online resources and facilitating the learners' journey of discovery and acquisition of new knowledge. Communication resources such as discussion boards enable learners to participate in collaborative learning with other students and with educators. Students can share ideas at anytime from anywhere through the online course.

Constructivist Learning Environments Dimensions

CLEs are technology-based in which students are expected to expose different activities and engagement in meaningful interactions (Jonasson, 1999). Students in CLEs should be provided with opportunities to negotiate ideas, conduct inquiry, and reflect their thoughts towards enhancing their cognitive and metacognitive outcomes. Taylor and his colleagues (1994, 1996) had conducted several CLEs studies a related to the measure of CLEs. It is believed that, the ICT tools such as 1:1 learning resources and its institutional approaches can bring and concretize the ideas of the Constructivist Learning Environments as mentioned by different scholars (Taylor, Fraser, 1991; Johnson & McClure, 2000; McClure & Gatlin, 2007). These factors are described as follows:

1. Personal relevancy of the students is important in the sense that it concerns with the connectedness of school [experiences] to students' out-of-school experiences, and on making use of students' everyday experiences as a meaningful context for the development of students' knowledge. As (Selvi 2007) asserted *"Science curriculum must be developed based on student and society needs, scientific and technological developments in the field of science and educational science.."*.
2. Student uncertainty involves the extent to which opportunities are provided for students to experience scientific knowledge as arising from theory-dependent inquiry involving human experience and values, and as evolving, non-foundational, and culturally and socially determined. Abma & Widdershoven, (2006) stated *"Central feature of dialogue are openness, respect, inclusion and engagement."*, while a great enhancement in scientific literacy is the explicit goal of science educators (von Aufschnaiter, Erduran et al. 2008).
3. Critical voice of the students involves the 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 and find room and other ways of knowing. This is clearly argued as Moore, (2006) asserted *"students' voices when critically reflect how they viewed their instructional practices can help to affirm students' to engage and contribute to positive changes in the classroom."*
4. Students' shared control concerns students being invited to share with their teacher controlling of the learning environments in a sense of articulation of learning goals, design and management of learning practices, and the determination and application of assessment criteria. Earlier, Vygotsky (1978) stated *"through practical activity a child constructs meaning on an intrapersonal level, while speech connects this meaning with the interpersonal world shared by the child and her/his culture"*. The greater perceived control offered by shared control will

reveal positive effects on students' motivation and reveals higher learning outcomes leading to higher performance (Moores & Chang, 2009).

5. The concept of students' negotiation is one of the most influential perspectives that directly affect students' knowledge, ideas, attitudes, and values when these students interact to each other's (Vygotsky, 1978). Students' negotiation considered as a key element in building classroom learning environment (Davis, 2006). A constructivist approach to learning is based on the idea that the learner constructs his or her own knowledge through negotiation of meaning (Hand, Treagust et al. 1997), which will confirms the need for cognitive performance of students in classroom is related to their interaction (Taylor and Cox 1997; Barron, Kemker et al. 2003). (Smith, Maclin et al. 2000).

Barriers of integrating constructivist learning environment in classroom

The school is considered to be a component of society. Yet, possible emerging pedagogies could be integrated in the public domain through schools. Schools now require teachers to place great concerns that related to communication skills, paths of students' personal learning, and student self-evaluation. Constructivism in practice may be defined as multi-interactions of different activities and contexts of teaching that bind together students, teachers, administrators and community as all of them participate in pedagogy.

Within schools' settings, different aspects might work against practicing applications of the theoretical ideals of constructivism. These barriers could include: (1) conceptual barriers which arise when there is a need to acquire new dimensions of instructional expertise that "are rooted in teachers' attempts to understand the philosophical, psychological, and epistemological underpinnings of constructivism;" (2) pedagogical barriers which arise from the need for teachers to develop more complex approaches to designing instructional materials that constructivist learning and the constructivist curriculum require because this necessitates that teachers work hard, concentrate more and embrace larger pedagogical responsibilities (Cohen & Educational Resources Information, 1988); (3) cultural barriers which emerge in the constructivist classroom involving teachers and students and which require an understanding of the norms and values necessary to accommodate the constructivist approach as it's crucial to understand and consider multidimensional cultural realities in school before implementing curriculum and pedagogical proposals (Zajda, 2004); and (4) political barriers which are associated with resistance from various environments outside the school and which require teachers to deal with. In the same vein, the constructivist 1:1 learning practice endorse a complicated concerns binds policy makers, teachers, students, and parents of students as they all participate in reforming the concept of teaching in general, and teaching for understanding in particular, in the school setting.

Learning Outcomes

Learning outcomes is the measurable cognitive dimension that occurs through the learning process. Students' cognitive processes refer to "students learning skills, critical thinking, high-order cognitive process, problem-solving capability, knowledge and skills in the key learning areas and the ability to transfer knowledge or skill." Also, "the affective domain includes attitudes, motivation and goal structures, and self-perceptions of ability or skill that include self-concept, self-esteem and self-efficacy". Initial learning goals are set by the instructor, but students have the chance to reflect learning that matches their individual interest (Driscoll, 2005; Johnson, 2000). Similarly, different measures could be used to measure affective student's outcomes in a constructivist learning as: "self-report measures", "classroom observations" and "analysis of student performance data". Some researchers (e.g. Hase, 2000; Woo & Kimmick, 2000) argue that the quality of learning materials is an important factor influencing the learning outcomes of students. It should be pointed out, however, that measuring students' learning outcomes is beyond the scope of this study.

Research hypotheses

The hypotheses for this study are based on CLEs conceptual framework and the measures as described above:

H1: Students' 'Personal relevance' understanding of constructivist practices using e-learning resources is positively related to their 'Perceived e-learning outcome'.
H2: Students' 'Uncertainty' understanding of constructivist practices using e-learning resources is positively related to their 'Perceived e-learning outcome'.
H3: Students' 'Critical voice' understanding of constructivist practices using e-learning resources is positively related to their 'Perceived e-learning outcome'.
H4: Students' 'Shared control' understanding of constructivist practices using e-learning resources is positively related to their 'Perceived e-learning outcome'.
H5: 'Student' negotiation' understanding of constructivist practices using e-learning resources is positively related to their 'Perceived e-learning outcome'.
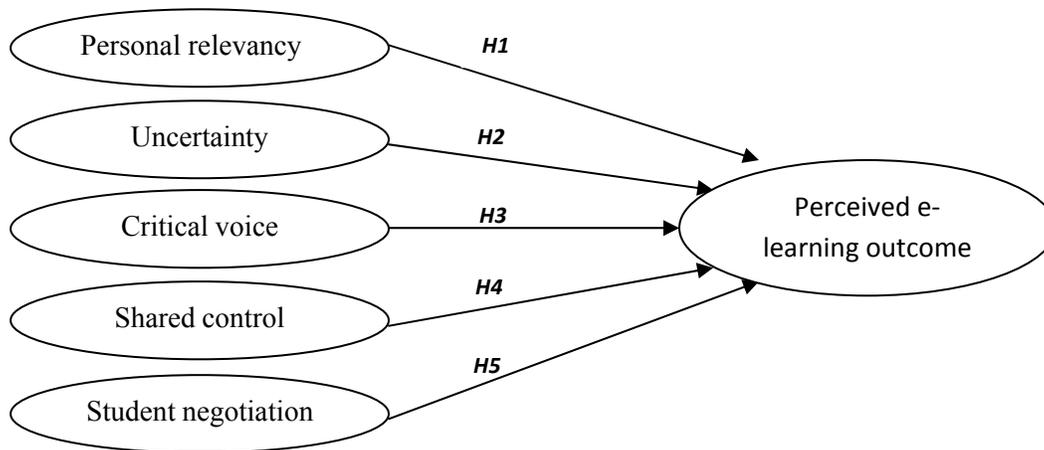

Figure 2: Hypothetical CLEs Model

Research Method

Overview

The study used quantitative research methods. The purpose of quantitative research is to describe phenomena numerically and to answer specific research questions. The aim of this study was to assess students' perceptions of their classroom experiences with 1:1 learning of computing and their understanding of the dimensions of Constructivist Learning Environments (CLEs) identified in this study. The study elicited data from Malaysian students from MOE-Intel schools which were utilizing in 1:1 learning resources through the introduction of Intel classmate PC (CMPC) program. A new Malaysia-version of the Constructivist Learning Environment Questionnaire (CLEQ) was developed to provide researchers or teachers with important information that could help improve the quality of the teaching and learning process. The internal consistency of CLEQ was examined using Cronbach's Alpha values (Table 1). Constructivist Learning environment (CLE) factors ("Personal relevance", "Uncertainty", "Critical voice", "Shared control", and "Students' Negotiation") was multiply regressed against student perceived learning outcomes (PRCVD) to identify level of classroom practices in a constructivist learning environment.

Methods and sample

The population of this study was Malaysian students who utilizing in 1:1 learning resources through the introduction of Intel classmate PC (CMPC) program. The questionnaire survey contains demographic questions and different parts of evaluations segmented as: (a) an evaluation of students' personal relevance of e-learning, (b) their uncertainty of science subjects, (c) their experience to speak out, (d) their shared control, (e) their learning negotiation, and (f) their assessments of perceived e-learning outcomes. In general, seven high schools and three primary schools were chosen by Malaysian MOE as a 1st phase to apply 1:1 e-learning Project (MOE report, 2007). Target students for this study were computer literate; able to speak in English; had exposure to different e-

learning resources; and able to access Internet. In addition, classroom is equipped with Wi-Fi connection; students' seats were allocated to facilitate groups' discussion, and equipped with small laptop for each student named Classmate PC (CMPC). From 10 selected schools of 10 different states, a total of 304 out of 608 students were randomly selected to participate in 'Constructivism Learning Environment Questionnaire (CLEQ) survey. After cleaning the data, this resulted in 291 usable questionnaires. Thus, 96% usable responses rate was achieved.

Analysis of the measurement of the constructs

The construction of CLEs Model was accomplished among several stages: (a) exploratory list of terms identified as: relevancy, uncertainty, critical voice, shared control, and student negotiation, (b) content validity which had been employed by careful selection of dimensions based on related literature revision and suggested methods for constructs and scale development obtained from pretested studies (Churchill, 1978, 1999), (c) construct validity with implementing discriminant validity that showed correlation among constructs are less than 0.9. (Hair et al., 2006), and convergent validity that, all items had loadings higher than 0.40. Further, convergent validity was ensured with Composite Reliability (CR) of 0.92 and an average variance extracted (AVE) of 0.53 (Hair et al., 2006). (d) Consistency reliability has been evaluated by computing the Cronbach's alpha coefficients for each scale (Table 1). All six of the subscales possess internal reliability of alpha greater than .70. The Kaiser-Meyer-Olkin (KMO) value is .805, and Bartlett's Test of Sphericity indicates that the significance level (sig) for Sphericity (2263.059) for the six-item correlation matrix is highly significant (p<.001). The significance value is p< .05, which confirms that this data is suitable for Factor Analysis. (Table 1). Factor loadings of each measurement-item and their corresponding components were generated (Table 1).

Table 1: KMO & Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.805
Bartlett's Test of Sphericity	Approx. Chi-Square	2263.059
	df	276
	Sig.	.000

From Table: 2, all factors-items has a loadings and a cut-off point of 0.40 and no significant cross loadings criteria were identified (Hair et al., 2006; Tabachnick & Fidell, 2000). This will further suggest that, CLEs confirms six factors corresponding to (RELV, UNCER, CRTVC, SHRCONT, NEGOT, and PRCVD).

Table 2: CLEs list of terms, Loadings, CA and AVE (Adapted from Taylor, Fraser, 1991; Johnson & McClure, 2000; McClure & Gatin, 2007)

Learning about the world (relevancy)			Loadings
CA =	A.1.1	1. The things I learn are relevant to me.	.840
0.740	A.1.2	2. I am enjoying of new ways of learning when I am studying.	.823
AVE =	A.1.3	3. The things that I learn about are relevant to my current and/or future educational environment(s).	.663
0.566	A.1.4	4. I learn things that are a part of my-out-school life.	.455
Learning about research process (uncertainty)			
CA =	B.1.1	5. I learn that classroom activities cannot always provide clear answers to problems.	.788
0.731	B.1.2	6. I learn that modern science is different from the science of long ago.	.788
AVE =	B.1.3	7. I learn that classroom activities can be influenced by people's experiences, opinions, and values.	.698
0.555	B.1.4	8. I learn that classroom activities are a way to seek better answers and generate new questions.	.688
Learning to speak out (critical voice)			
CA =	C.1.1	9. I feel safe questioning what or how I am being taught.	.782
0.764	C.1.2	10. I feel I learn better when I am allowed to question what or how I am being taught.	.777
	C.1.3	11. It's OK for me to ask my teacher for clarification about activities that are confusing.	.749
AVE = 0.585	C.1.4	12. My teacher encourages me to ask questions to clarify ideas, or to deepen my	.704

		understanding.	
Learning to learn (shared control)			
CA = 0.765	D.1.1	13. I help to plan what I am going to learn.	.858
	D.1.2	14. I help to decide how well I am learning.	.835
	D.1.3	15. I help to decide which activities work best for me.	.755
AVE = 0.800	D.1.4	16. I let the teacher know when I need more or less time to complete assignments.	.533
Learning to Share (Student negotiation)			
CA = 0.750	E.1.1	17. I Talk with other students about how to solve problems.	.878
	E.1.2	18. I ask other students to explain their ideas.	.781
	E.1.3	19. I am asked by other students to explain my ideas.	.687
AVE = 0.573	E.1.4	20. My teacher encourages me to raise issues and ask questions with other students in order to clarify and inform our thinking.	.569
Perceived E-Learning Outcome (Student Experience)			
CA = 0.767	F.1.1	21. Using the e-learning resources improved my critical thinking	.853
	F.1.2	22. The e-learning resources help me understand the subject contents more in-depth.	.820
AVE = 0.60	F.1.3	23. I enjoy using different learning modes to learn.	.810
	F.1.4	24. The e-learning resources help me understand the subject contents quicker.	.513
Note: CA = Cronbach Alpha, AVE = Average Variance Extracted			

Results

Table 2 shows the items of each construct (relevancy, uncertainty, critical voice, shared control, students' negotiation and learning outcomes). The descriptive summary and correlation coefficient are provided. The highest value for each construct's item with at least one other item in the construct within 0.3 to 0.9. The factor loadings are provided in the last column of table 2. Each factor score was saved under a given name (RELV, UNCER, CRTVC, SHRCONT, NEGOT, and PRCVD) to be used for further analysis.

Findings

Multiple regressions was used to evaluate the relationship of the constructs with perceived e-learning outcome. Multiple regression aims to use the independent (predictor) variables whose values are known to predict one dependent (criterion) variable (Hair, 2010). Using Stepwise Method, four items were entered (RELV, UNCER, SHRCONT and NEGOT) and one item (CRTVC) failed to meet the criteria (entered). The R^2 value was 26.5% and adjusted R^2 was 25.5%. The R^2 indicates that 26.5% of the variance in P can be explained by RELV, UNCER, SHRCONT and NEGOT. In the ANOVA table, the F-Value was 25.8, and the degree of freedom (df) was 4 and residual was 286. The p-Value of the test was less than 0.001. Therefore, P depends on all factors except CRTVC.
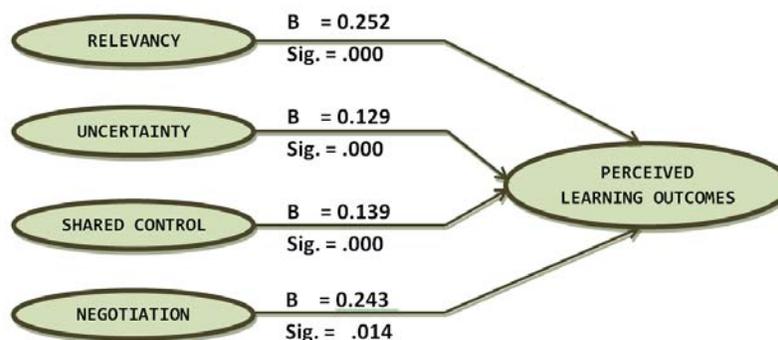

Figure 3: Relationships of CLEs factors with Perceived e-learning outcome

Discussion

This study suggests that, students' CLEs for classroom practice is positively related to their "perceived e-learning outcomes". The "perceived learning outcomes," is a result of student's real interaction of real world problems as Jonassen & Jonassen (2006) believes learners should be presented with interesting, relevant, and meaningful problems to solve. Student's learning experience concerns the level and source of motivation for learning which revealed a workable confidence level to students in his or her potential of learning (Glasersfeld, 1989 #360). This viewpoint chime with CLEs concept that students' constructivist classroom outcomes is a function of their beliefs and practices of e-learning resources and supported with real world problems and improvement in student attitudes toward science (Yore, et al., 2005). The results suggest that "perceived e-learning outcomes" of the students is a function of different factors (Personal relevance, Uncertainty, Critical voice, Shared control, and Students' negotiation). These factors are discussed below.

Personal relevance

The hypothesis result extracted from regression analysis, suggests that students' 'personal relevance' (RELV) has a positive "t-value" (4.067) and a significant p-value (p < .05) influence on students' 'perceived e-learning outcome'. About 23.4% of the variance in the 'perceived e-learning outcomes' score can be accounted for by the 'personal relevance' (RELV) score. The findings support the first hypothesis (H1). The study suggests that, students' courses need to have content which has relevance to out of school life. Moreover, students need to practice and experience personal knowledge through reflection, critical thinking, and self-regulated learning, otherwise their learning is only superficial and their way of thinking is not modified (Piaget, 1989). Similarly, Piaget (1989) argues that, "What has not been acquired through experience and personal reflection can only be superficially assimilated and does not modify any way of thinking" (p. 252).

The theoretical and empirical implications of the findings are that, the students' learning outcome could be enhanced in class if students perceive more personal relevance in their studies and are able to express different issues related to their learning and can view science subjects as changing phenomena.

There is still a need for further research on students' personal relevance in relation to knowledge acquisition and learning within Malaysian educational context. The MOE is thus "concerned with different knowledge transfer strategies such as codification and personalization" (Werr & Stjernberg, 2003). However, there is a few debate concerning students' sense-making of professional interacts with the socio-cultural context during their process of in-school and out-of-school knowledge transfer. It is quite important to see the school as an institution that has valuable "effects on knowledge development" (Robertson, Scarbrough, & Swan, 2003), and to define what role the MOE can play in becoming a source of innovation (Nikolova, 2007) that could facilitate students' ability to perceive more personal relevance in relation to science subjects and to understand science phenomena. Yet, the study recommends that further research is needed to examine the extent to which the 'personal relevancy' scale generates a plausible account of "classroom learning environments" that offer extensive opportunities for students to develop their understanding of the relevancy of their in-school learning to that of real-world problems and related activities outside school."

Student uncertainty

The hypothesis result extracted from regression analysis (Figure 3) suggests that students' 'uncertainty' (UNCER) has a positive "t-value" (1.983) and a significant p-value (p < .05) influence on their 'perceived e-learning outcomes'. About 10.3% of the variance in the 'perceived e-learning outcomes' score can be accounted for by the students' 'uncertainty' (UNCER) score. The findings support the second hypothesis (H2).

The practical implications of the findings are that students' uncertainty in relation to the constructivist e-learning environment influences their cognitive processes and engagement with activities carried out by scientists (Brill & Yarden, 2003; Chinn & Malhotra, 2002; Lin & Tallman, 2006). Although, scientific inquiry itself is a complex form of human thought and can be considered in a Vygotskian sense as a "cultural tool" (Wertsch, 1991), which Malaysian students should implement as an approach to reasoning that others have found useful. From the socio-

cognitive perspective, three principles underpin these scientific inquiry instructions: (a) engaging students in reasoning practices in science subjects; (b) offering explicit guidance on the roles students can assume to monitor their own and their peers' thinking; and (c) fostering a sophisticated epistemology of science by having students experience science as a process of revision. Within the MOE-INTEL classroom, students are able to share aspects of learning science with their teachers and express their doubts about specific science topics. However, "knowledge only has a lasting effect when it is integrated into a student's cognitive structure in a way that it is properly understood, and appears relevant, useful and important to the student's learning context when build up be assigned members and integrated into their cognitive structure in understandable way" (Reihlen & Apel, 2007).

This study is thus argues that, in order to determine the extent to which items in the 'uncertainty' scale can elicit dependable and clear responses, it is necessary to investigate 'uncertainty' in a classroom learning environment that provides rich and sustained experiences in a predefined science topic whose learning goal has been affirmed by the constructivist teacher. Teachers themselves also need to have an adequate pedagogical and conceptual understanding of constructivist learning."

Critical Voice

The hypothesis result extracted from regression analysis (Figure 3) suggests that students' 'critical voice' (CRTVC) has a positive "t-value" (1.217) but not a significant p-value ($p > .05$) influence on their 'perceived e-learning outcomes'. The findings would appear not to support the third hypothesis (H3). In Malaysian schools, students are expected to be exposed to a different range of media and it is the responsibility of teachers to equip students to engage and learn critically in their classrooms. The practical and theoretical implications of these findings regarding the students' critical voice are that it directly influences their socio-cognitive process. The evidence from the analysis suggests that, in order to enhance the attribute of the sound voice in Malaysian students which is required for their learning environment, the revision of their learning strategy should be enlarged to consider: (1) defining social and cultural presence to facilitate students' ability to feel socio-culturally connected to their classroom and learning environment (Aragon, 2003); (2) providing opportunities for students to interact and share different ideas regarding course content as an effective way to engage students in learning activities; and (3) improving motivation and encouraging bonding between students (Pratt & Palloff, 2007).

Yet, students' "Critical Voice" should be treated as a critical "CLEs" factor that offers extensive opportunities for students to critically judge their learning environments. Significantly, teachers' lack of constructivist epistemological skills may contribute to a major impediment that can distract from student's role in the 'critical voice' dimension of the constructivist learning environment scale. Further research is thus needed on the critical voice of students, the focus of which should be broadened in the context of the enculturation of constructivist pedagogy in Malaysian schools.

Shared Control

The hypothesis result extracted from regression analysis (Figure 3) suggests that students' 'shared control' (SHRCONT) has a positive "t-value" (2.581) and a significant p-value ($p < .05$) influence on their 'perceived e-learning outcomes'. About 13.9% of the variance in the 'perceived e-learning outcomes' score can be accounted for by the 'shared control' (SHRCONT) score. The findings support the fourth hypothesis (H4). There is a need to effectively develop shared control strategies in the learning environment that will allow students to be adept members of today's multi-literate society (McNaughton, 2002). However, the students' role in these aspects has too often been reduced. Students should be educated to utilize their capability to question their teachers' on their pedagogical plans. Additionally, students within a "CLEs" should be invited and encouraged to share with their teachers' articulation of learning goals; designing and managing their learning activities; and be able to determine different assessment criteria for their learning activities. The practical implication of the findings of this study is that, acting of the constructivism learning teacher as a facilitator will provide students with variety of learning experience from which learning is build and this will foster social interactions between students themselves towards negotiate meaning of their learning (Brooks & Brooks, 1999). Similar findings also had been argued Nunes & McPherson (2003) who asserts that "Students are expected to develop high cognitive skills such as negotiation of meaning and metacognition supported by teachers who often may lack these skills themselves" (P.

146). Also, role of constructivist classroom teacher should concern facilitating the process of teaching-and-learning in away that locus of the control for learning is passed from the teacher to the learner in a careful guided way. As students' "self-efficacy" will increase (Hase, 2000), and the amount of effort and time teacher and student is willing to devote to the task also increases, leading to higher performance (Moores & Chang, 2009). Generally, the greater perceived control offered by shared control, the greater the positive effects on students' motivation, demonstrated by increased task involvement, which in return will lead to higher learning outcome.

Students' Negotiation

The hypothesis result extracted from regression analysis (Figure 3) suggests that student negotiation (NEGOT) has a positive "t-value" (4.714) and a significant p-value (p < .05) influence on their 'perceived e-learning outcomes'. About 26.9% of the variance in the 'perceived e-learning outcomes' score can be accounted for by the 'student negotiation' (NEGOT) score. The findings support the fifth hypothesis (H5). The concept of student negotiation is one of the most influential perspectives that directly affects students' knowledge, ideas, attitudes, and values when these students interact with each other (Vygotsky, 1978). The affective interaction of students in their learning environment places the students' relationship with each other in the foreground because negotiation, cooperation, conflict, rhetoric, roles, etc. are important as means by which students are able to construct knowledge (Gergen, 2001). The implication of student negotiation of meaning in the domain of education confirms the need for cognitive frames of references as the performance of students in the classroom is related to team interaction (Barron, 2003). Similarly, students will have greater opportunities to negotiate when they have a trusting relationship with their classroom teacher, which in fact is considered a key element in building a classroom learning environment (Davis, 2006; Davis & Cosenza, 1993; Davis, 2006; Turner et al., 1998; Turner et al., 2002).

Perceived e-learning outcome (student outcome)

The results from the quantitative data collected suggest that four hypotheses are supported, which are related to: personal relevancy; uncertainty; shared control; and student negotiation. One hypothesis is not related: (H3) students' 'critical voice' is positively related to their 'perceived e-learning outcomes' (p > 0.05). To sum up, the findings of this study revealed that students who perceived their learning environment in a more constructivist-oriented manner believed that knowledge is changing and that they have ample opportunity to think critically and adopt meaningful learning strategies.

The students' 'perceived e-learning outcome' is positively related to four dimensions of CLEs. The results derived from the conceptual framework of the study (Figure 2), and the multiple regressions analysis, represented in the Constructivist Learning Environment Model (CLEM), (Figure 3), and hypothetical results, suggest four hypotheses are supported, which are: (H1) students' 'personal relevance' understanding of constructivist practices using e-learning resources significantly influences 'perceived e-learning outcomes' (t-value 4.067, p-value p<.05); (H2) students' 'uncertainty' understanding of constructivist practices using e-learning resources significantly influences 'perceived e-learning outcomes' (t-value 1.983, p-value p<.05); (H4) students' 'shared control' understanding of constructivist practices using e-learning resources significantly influences 'perceived e-learning outcomes' (t-value 2.581, p-value p<.05); and (H5) students' 'student negotiation' understanding of constructivist practices using e-learning resources significantly influences 'perceived e-learning outcomes' (t-value 4.714, p-value p<.05).

Some researchers (e.g. Hesse, 2004; Woo & Kimmick, 2000) argue that, the quality of learning materials is an important factor influencing the learning outcomes of students. A learning environment where students are able to contribute to their acquisition of their knowledge through experimentation, observation, raising their voices, questioning, and negotiating with their teachers and peers can help students realize that scientific knowledge is evolving, and they are then apt to enter an enriched new learning environment (Hanson-Smith, 2000). Similarly, Cano (2005) highlights the importance of the relationship between the learning environment and students' metacognition and epistemological beliefs. He asserts that,

"A student's academic performance or achievement will depend on his/her approach, which in turn will depend on other factors. These are characteristics of the teaching context (teaching styles, ways of assessment, etc.) and the pupil's perception about this context (learning environment) and the

academic tasks set (metacognition), which is also related to his/her personal characteristics (intellectual skills, personality, etc.), including beliefs about knowledge and learning (epistemological beliefs)" (p. 205).

Overall, students' understanding of the five dimensions of CLEs establishes a positive relationship between the students' constructivist learning environment and their perceived e-learning outcomes.

Based on the constructivist assumption that students need to feel the ownership of their knowledge construction, future research is needed to evaluate students' beliefs regarding their contribution to their learning outcomes. Students' perceived learning outcome could be a subject of further study that could investigate the extent to which students' beliefs in their learning environment, and their intention to fully engage in understanding and utilization of "CLEs" dimensions as well as their reaction to values, affect the quality of their self-regulatory learning

Future Research

Future research is needed on one constructivism learning strategy (e.g. Problem based learning) and how they use it in-and-out-of Malaysian schools. However, integration of ICT in school's pedagogy and students' computer literacy towards their learning outcome in a constructivism learning environment could be another dimension to be considered. Moreover, intervention studies can be conducted to determine connections between teacher's pedagogical practices and conservative beliefs and attitudes in a constructivist learning practices. Finally, Gender differences in classroom practices and learning outcomes is also possible when learners are required to construct their own learning. To which extend does the gender will vary when it comes to this concept? As Hoffman (2008) argued "*While the trends indicate both sexes are using social media in huge numbers, our findings show that women far outpace the men*". Does this could be possible in Malaysian schools when applying 1:1 learning environment strategy?

Conclusion

The dimensions of Constructivist Learning Environments are the practical measurable constructs that were used in this study. A review of various studies shows that the majority of early studies on the learning environment were conducted in Western countries; however, over the last decade, Asia-based researchers have made important contributions to this field (Fraser, 1998). Studies conducted in Indonesia (Margianti, 2001), Singapore (Chionh & Fraser, 2009), Korea (Kim, Fisher, & Fraser, 1999), and Brunei (Scott, 2001) have replicated prior research findings, namely that the psychosocial aspects of the learning environment are an important determinant of student outcomes. Despite the fact that a great deal of learning environment research has been conducted all over the world, there are few related works that have been undertaken in regard to the constructivist learning environment in Malaysian schools. Different studies (Taylor, & Fraser, 1991; Fraser et al., 1997) have conducted investigations into several CLEs and measures as well as on the introduction and use of 1:1 learning resources in the Malaysian MOE-Intel classroom.

The main contribution of this research is that it adds to our knowledge and understanding of the concept of constructivism in education. The contributions of the study are: (1) the concept of constructivist learning is grounded with accessible pedagogies that frame constructivist learning. This study identified and compiled literature that focuses on CLEs within the Malaysian school context that emphasizes the integration of multimedia technology in a 1:1 learning environment, and identified different barriers teachers may face when attempting to implement the concept, (2) the theoretical framework of this study identified different barriers impeding the implementation of constructivist learning within Malaysian schools, and how it prevent implementation of constructivist learning that promotes students' development and encourages positive learning outcomes, (3) this study identified a new instrument CLEQ and proposed as a Malaysia-version, providing teachers or researchers with information that could assist in improving the ultimate quality pertaining teaching and learning process within a constructivist learning, (3) based on both theory and empirical findings, the study proposed a Constructivist Learning Environments Model (CLEM) that explains how using different constructivist learning factors "Personal Relevance", "Uncertainty", "Critical Voice", "Shared Control", and "students' Negotiation" in 1:1 e-learning influences students' perceived e-learning outcomes, and (4) by taking into account the Malaysian MOE school

reform strategy, namely, the MOE-Intel project, this study also addressed the context of constructivist learning within a 1:1 learning environment that is characterized by the integration of ICT and multimedia technology into education and laptops for students (CMPC). The findings from this study contribute to the growing body of knowledge on the learning experience in Malaysian schools and specifically in respect of the 1:1 learning environment through the example of the MOE-Intel project.

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