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The Effectiveness of Using Teaching Module Based on Radical Constructivism toward Students Learning Process

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Abstract

This research review the effectiveness of teaching module based on radical constructivism towards rural students in Sabah. This research uses embedded design (quasi experimental and case studies). Researcher use 70 students as are sample who were chosen by purposive and matching sampling. A total of 35 students were chosen as the treatment group and the rest are control group. Researchers develop teaching modules for Geography subject based on radical constructivism known as Geography Teaching Module CSAA to overcome the rural students' learning problem. The teaching module consists of three main phases which are cognitive scheme; assimilation and accommodation used as intervention to the treatment group. Meanwhile, the control groups were taught using the teacher-centered approach. Data were collected through pre and post tests, observations and document analysis conducted by the researcher. Analysis of Variance (ANOVA) showed that there was no difference in post test scores for the control and treatment group of low cognitive level. Meanwhile, analysis of variance (ANOVA) for medium and high cognitive level showed significant difference between the two groups. The findings show that the use of Geography Teaching Module CSAA can improve students' thinking skills. The implementation of Geography Teaching Module CSAA could increase thinking skills as the use of student-centered approach to encourage students to participate actively in the discovery of knowledge (qualitative data).

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Keywords: Constructivism radical; teaching module CSAA; mixed methods; cognitive scheme; assimilation; accommodation.

1. Introduction

Constructivist approach is a psychological approach based on genetic epistemologies that were developed by Jean Piaget in 1967. This approach has attracted wide attention among practitioners in the West, particularly in

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the fields of Mathematics and Science education (Steffe & Gale, 1995; Treagust, Duit & Fraser, 1996; Von Glasersfeld, 2008). There are three types of constructivism, which was introduced in the field of psychology; one of the types is a radical constructivist approach. According to Von Glasersfeld (1995), radical constructivist approach is a philosophical epistemology about how people learn things in a rational manner. An interesting thing that radical constructivism is featured in this approach put the responsibility to act, think and build knowledge on the shoulder of each of the individual (Nik Pa, 1999; Von Glasersfeld, 2008).

According to Von Glasersfeld (1995), the conceptual structure owned by each individual is formed through a process of continuous construction. Thus, the radical constructivist approach sees the individual as knowledgeable and active. Therefore, the process of learning is active construction, recursive and continuous. In other words, student is building their own knowledge. This means that knowledge cannot be transferred in their mental as someone pours the water into empty bottles. Instead, students construct their knowledge through the selective experience to create a conceptual structure that forms the basis of their knowledge.

Studies conducted by several researchers found that the radical constructivist approach succeeded in increase understanding, higher thinking order and interest of students towards science and mathematics (Steffe & Gale, 1995; Gagnon & Collay, 2001; Von Glasersfeld, 2008). Radical constructivist approach in teaching and learning is more to student centered and materials. These mean that students are actively involved in the learning process (Tobias & Duffy, 2009). Teachers are also served as facilitators who guide students in their teaching and learning process (Raman, 2006; Lee, 2007). Thus, researchers concluded that the radical constructivist approach was suitable to overcome this learning problem and performance of students in Physical Geography (Lee, 2007; Tobias & Duffy, 2009). There are some similarities between the subject mathematics, geography and science as these subjects involve the acquisition of mathematics concepts (Raman, 2006). Learning problems commonly faced by students in geography subject is low proficiency in the concept (low level) that cause the student cannot answer the higher cognitive level questions. Consequently, students will be unable to understand or relate to a process or event in the physical environment activities (Syed Abdullah, 2004).

2. Statement of problem

Teaching and learning process for Geography requires a change in its approach to determine its effectiveness. Innovation and a variety of approaches are needed to make teaching and learning of physical geography favored, consistent with the objectives of this subject as a foundation for individuals who are concerned about the environmental balance (Malaysia Examination Council, 2007). This means that the teacher's role is crucial in molding the future generation. Hence, the Malaysian Examinations Council (2007) has suggested several methods and techniques in teaching and learning of physical geography. However, a study conducted by Othman (2007) found that the very popular method used by the teacher is lecturing.

Analysis document of student answers showed that most of the candidates failed to understand and master the concepts in Physical Geography (Syed Abdullah, 2004; Raman, 2006). It will affect student's ability to solve the higher cognitive level (Othman, 2007). The difficulty for students to master and understand the concept will result in student failure to understand the formation of the physical phenomenon. For example, the low proficiency of the concept of erosion causes students failed to link the occurrence of weathering erosion and mass movement. This failure will affect the students' performance in examinations (Syed Abdullah, 2004; Othman, 2007).

Teaching method and approach will determine the level of proficiency of students in physical geography subjects. Teachers should use student-centered approach to stimulate the students mind thus help students acquire and master the knowledge of Geography. Findings of Wan Hussin (2002) showed that the methods most frequently used by geography teachers are 75 percent lecture and giving notes, and the remaining is discussion method. Wan Hussin (2002) also found that students are very interested in the learning methods such as the use of diagrams, mind maps, group discussion and the use of Information Communication and Technology in

teaching and learning. Therefore, the researcher has developed teaching modules CSAA to overcome the students learning problems, lack of interest and academic performance.

3. Objectives of the study

In particular, the objectives of this study are:

- Examine the effects of CSAA Module towards students' performance.
- Explain how CSAA Module can solve the learning problems.

4. The Proposed Construction of CSAA Module

Radical constructivist approach introduced by Glasersfeld (1980) and Steffe and Gale (1995) did not submit a specific pedagogy to be followed by teachers in teaching and learning process. According to Glasersfeld (1980) and Glasersfeld (2008), teachers can use this approach with their own technique as long as it is still based on the foundations of radical constructivism approach. Researchers using the radical constructivist approach to building students' understanding and develop the students' contribution in building knowledge process (Singer & Moscovici, 2008). To achieve these goals, teachers should know the efficient teaching methods. Thus, researchers have developed modules CSAA for physical geography, which includes three phases which are cognitive schemes, assimilation and accommodation.

4.1. Cognitive Scheme Phase

The cognitive scheme has three sub-phases, which are triggers phase, specific activities phase and outcomes phase. During triggers phase, students are given an issue, students are required to link the issues assigned with their existing knowledge. At this level students will use a motor action (kinesthetic) that is self-inflicted. Teachers will stimulate students' knowledge with questions or actions that guide students to the achievement of the desired behavior. At this stage, teachers will ignore students' curiosity.

The second sub-phase is exploration activity. During this phase students will relate their existing knowledge and the issues that are given by the teacher. Students also discuss and compare their ideas with classmates. Through this phase, students may find that their existing knowledge is insufficient to resolve the issue. Teacher will stimulate them to get more information from books or the internet. In addition, students can also create links between the variables appearing in the issue under review, the limitations of the study issues and more accustomed to use higher-order thinking such as the level of synthesis, analysis and evaluation.

The third sub-phase is the expected result. Students' understanding would increase from concrete level (own experience) to abstract (restructuring) and concrete thinking to resolve issues that have been given by the teacher. The process is repeated each time will help students to organize information effectively and be able to generalize (Singer & Moscovici, 2008). The role of teachers and students during this phase of the cognitive scheme is described as in Table 1.

Table 1: Role of Teacher and Students during the SCAA Cycle: Cognitive Scheme Phase

Teacher Role		Students Role
What to do?	Teachers' activities	
Trigger phase		Evoking
How do I encourage students' curiosity?	Provide issue based on real-life problems to create conflict in the minds of students to motivate the students to solve the problem.	Find ways to solve the problem (cognitive conflict): identification of the concept, time related phenomenon, known methods available through the sharing of views with a group (peer group).
How do I answer the questions of students and encourage them to set learning objectives?	To provide learning situations that encourage students to use concepts, operations and behaviors needed to understand the issues assigned by the teacher.	Selecting the existing concrete experience and use the experience to solve problems.
How to analyze students' prior knowledge and experience?	Identify existing knowledge about the topic taught students through tests, interviews or question and answer.	Planning and implementing the first attempt to solve the problem given by the teacher (student to complete the task or modify the solution). Conduct surveys, observing phenomena, collecting data from various media to help them think about the concept or topic of discussion. Using imagination and try to understand a group to solve the problem given by the teacher. Organizing own knowledge with other students and the state variables involved.
Problem construction		Exploring
What educational content selected? and the content of the lessons that will be explored by students?	Expose students to a variety of materials related to the topic. Provide guidance to ensure continued exploration.	Identify the research problem and determine how to solve the problem. Find ways and experiences of the previous solution. Collect and record their information
What are the exploration activities that enable students to understand the concept?	Do not define the term / concept or explain the evidence before the students completed the attempt to solve the problem.	Create criteria based on or derived. By analogy with the previous situation, students answer questions and to form an investigation to test hypotheses and identify the risks faced.
What types of observations can be used by students?	Facilitate student but let the students make their own.	Share their experiences with other students (peer-group) and not limitation in just one experience.
What are the questions that need to be asked to motivate students to explore?		The process (record, comparison, classification and description) complete, the lack of analysis, attempting to develop the concept note of their own knowledge. Students begin to relate between the intervention and research findings.

Source: (adapted from Singer & Moscovici, 2008)

4.2. Assimilation Phase

During the assimilation phase, the level of student understanding will increase as they interpret the concrete results of their experience during the phase of repeated cognitive schemes. There are four sub-phases of this phase which are systematization, conceptualization, synthesizing and explaining. In the systematization phase, teachers act as facilitators to support students by helping them to express synthesize observations and concludes the findings (Tobias & Duffy, 2009). During conceptualization sub-phase, teachers should help students to use concepts, general conclusions and findings to develop much larger issue than the issues discussed. Meanwhile,

during synthesizing sub-phase, teacher should involve students to generalize their result. The next sub-phase is explaining. This sub-phase requires students to relate the concrete knowledge to the abstract knowledge. It means students have to compare they own knowledge with other students.

At this stage, students learn how to compare the difference between opinion and fact. They should know the limitations of the study and use appropriate language during the process of knowledge sharing. In addition, the process of knowledge construction will be from concrete to the real world. However, if the actions activities such cognitive schemes do not lead to the expected outcome for some reason this will cause interference which lead to accommodation (Lee, 2007). Table 2 shows clearly the role of teachers and students during the second phase of the assimilation phase.

Table 2: The Role of Teachers and Students During CSAA Cycle: Phase Assimilation

Teacher Role		Students Role
What to do?	Teachers' activities	
Structuring		Synthesizing
How do students evaluate their exploration process?	Assist students to state their observations, conclusions and their conclusions.	Identify the difference and identify similar findings. Generalize the findings from the research.
How can students identify their understanding?	To help students formulate their findings. Synthesize the students' new concepts related to observation.	Refine concepts or solutions used. Synthesize study, detailing the steps, definition, rules used to solve the problem. • State resources are used to obtain information such as textbooks, internet, magazines and so forth.
Conceptualization		Explaining
How do students use the concept of learning?	Introduces new terms	Provide an overview by example and analyze the results of exploration.
How to motivate students to find additional information and answers to every question?	To help students create the model of the object to be explored and generalize other objects during exploration. To help students reflect their ideas or new concepts	Linking knowledge and understanding to explain new ideas about the entities in carrying the study. Produce an example of a statement. Debate, prove and explain the basic assumptions. Renovate regulations, etc. produced by the other partners to produce a correlation. Understand and accept the limited knowledge of yourself and your friends. Therefore, try to obtain additional information.

Source: (adapted from Singer & Moscovici, 2008)

4.3. Accommodation Phase

During this phase, students will learn how to use their abstract knowledge. Then they modify their patterns of knowledge in order to generalize and applicable to a wider range of situations. During this phase, teachers will explain the concept formation, inquiry process and its limitations. Sometimes a teacher may have chosen to use a concrete example (sub-consolidation phase) or the teacher uses examples that are not related and relevant to show the relationship. In addition, teachers also play a role as a leader to lead students to the restructuring scheme. Restructured scheme is known as the internal scheme. Construction of the new scheme or modification of existing schemes will be involves the process of accommodation by an individual in the context of the experience to eliminate interference. The role of teachers and students for accommodation phase is shown in Table 3.

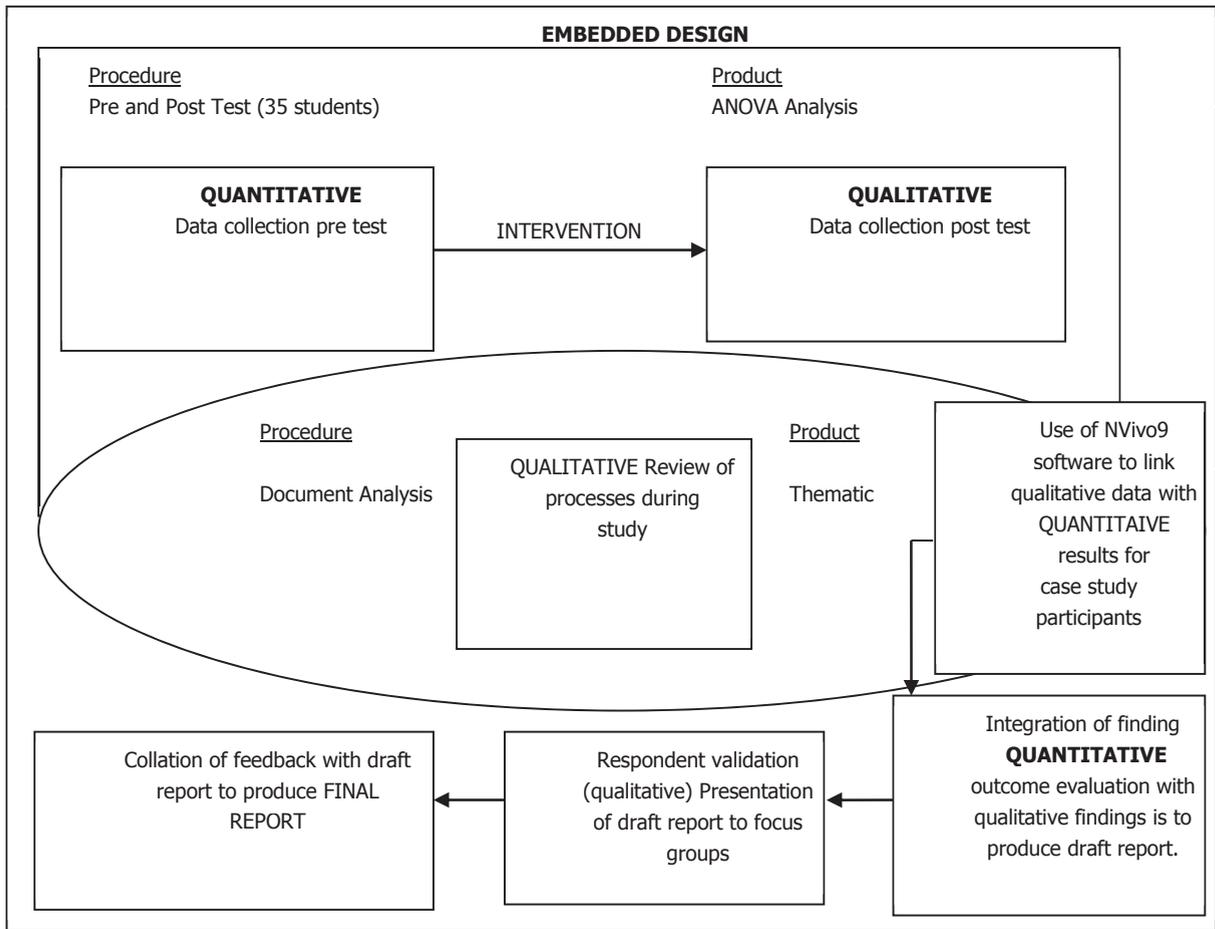
Table 3: The Role of Teachers and Students During CSAA Cycle: Phase Accommodations

Teacher Role		Students Role
What to do?	Teachers' activities	
Reinforcement		Practicing
How do I assess student understanding?	Recommend the application form of activity.	Use their knowledge to different situations.
What are the aspects that need to be reinforced?	Suggest additional strengthening activities.	Transferring knowledge through analogy.
What is the limit / situation will be stressed when learning concept used?	Provide opportunities for students to be independent learn concept / product / theory. This helps students develop their own ideas.	Recommend information about a case and explained that if students are not satisfied with the features of a product / concept / theory.
How do students use the skills?		Relate the various categories that describe a product, concept and assessment.
Transfer		Accommodation
How do students identify the relationship between the concepts they have learned with other concepts?	Reforming the relationship between the concepts of a program that has been studied with a new concept from other fields.	Explore the application of a concept / product to new situations.
How do students solve new problems by using techniques that have been learned?	Making links with other disciplines. Propose a new context for applying the model.	Make a trial against a decision to form the new criteria to determine the value of a product. Using previous research applied to new situations.
How do students apply their knowledge to solve new situations?	Provide learning outside the classroom.	Integrating, discussing a context and react with the possibility of problems / limitations that will arise from new knowledge. Compile the program: to build the answers to the questions that were submitted. Decide how to use learning strategies followed to solve various problems. Forecasting how to solve the problem will come more quickly.

Source: (adapted from Singer & Moscovici, 2008)

6. Methodology

This study used embedded design approach based on pragmatism. This design was chosen because each of the questions required more than one data used to provide a comprehensive picture. This study has used quasi experimental study (quantitative) combined with case studies (qualitative). A total of 35 form six students at school A were selected using purposive sampling. Meanwhile, the control group were selected from all schools in the district of Kudat. Researcher used matching sampling to ensure that the findings of the pre and post test were due to the use of CSAA module. The implementations of treatment were carried out twice a week. For each meeting require 80 minutes and carried out in six weeks. Researchers used pre and post tests to measure student performance. Researcher also used the Student Reflection Form (document analysis) to obtain information relating to the implementation of teaching and learning using CSAA module and students interest. In addition, researchers are also triangulate data by using structured observation to obtain information on the role of teachers and students. The quantitative data are analyzed using SPSS version 18.0 and qualitative data are analyzed using NVivo 9.



Source: Adapted from Brady and O’Regan (2009).

Fig. 1. Research design

7. Findings

The Findings showed that constructivist teaching approach (Module CSAA) and the traditional approach had the same effect on student knowledge at a low cognitive level (cognitive level of knowledge and understanding). Analysis of variance (ANOVA) showed $F(df = 1, P > .05) = .982$. Therefore, the hypothesis was accepted because H_0^1 (ANOVA) showed no difference in score points between the control and treatment of low levels of cognitive tests.

Instead of the hypothesis H_0^2 and H_0^3 were rejected due to score points for both groups, there were variations. H_0^2 and H_0^3 hypothesis was rejected because scores points for moderate cognitive level is $F(df = 1, P < .01) = 38,024$ and high cognitive level were $F(df = 1, P < .01) = 23,091$. The results showed that the uses of CSAA module could enhance higher order thinking skills among students. The findings of qualitative data through observation and document analysis were used to answer the following questions:

7.1 How does the use of teaching modules CSAA improve students' performance?

Document analysis using NVivo 9 shows how the use of CSAA modules enhance student performance through learning based on problem solving, presentation, construction of concept maps and answer exchange with a partner. Student 1 stated ". . . I understand the subject much easier today because teachers provide questions that encourage me to think. I am very excited to do these assignments with my friend. Exchange sessions allow me to correct my answer and track my weakness ... "Student 7 also added "... today my teacher uses another approach. We are given a question, I am told to find our own answers first, then sharing our answer with friends. We exchange ideas through the question and answers session with classmates and teachers, Our class is so noisy today. But I would understand the subject better because we do concept maps again ... "NVivo analysis 9 showed that almost 80 percent of the students stated that their understanding and thinking skills improved because of the CSAA module.

8. Discussion

The findings of this study indicated that the use of CSAA modules had the same effect with the traditional approach to increase the low cognitive level. This finding was consistent with the study conducted by Nair (2005) who found no differences score marks between control group and the treatment group of low cognitive level. However, CSAA Teaching Module was very effective in enhancing cognitive skills of students in higher thinking order. The findings of this study (geography) indicated that the radical constructivist approach could be applied to other sciences social subject. This finding was consistent with the findings of previous studies as done by Steffe (1995) and Glasersfeld (2008) which stated that the use of this approach is able to familiarize students with problem solving and higher order thinking skills.

The results showed that the used of CSAA module could improve students performance through learning based on problem solving, presenting, construction of concept maps and exchanged answer with a partner. For example, students would be more understand the subject when teacher created problematic situations that enable them to exchange answers and detected their weaknesses. In addition, Student 7 also added that their role as pioneers of knowledge enabled them to better understand and controled through brainstorming sessions and the construction of concept maps. The using of this module attracted students to participate actively in the process of teaching and learning (Lee, 2007; Glasersfeld, 2008; Matanluk, 2011). This finding was in line with research done by Shamsuddin et al. (2005), Lee (2007) and Tobias & Duffy (2009).

The used of CSAA module managed to increase understanding, knowledge and interest of students in Geography (Steffe & Gale, 1995; Gagnon & Collay, 2001; Glassersfeld, 2008). Radical constructivist approach in teaching and learning was more students centred and materials based. Therefore, students were actively involved in the process of problem solving (Tobias & Duffy, 2009). The teacher might only act as facilitators who guided students in teaching and learning process (Raman, 2006; Lee, 2007). Active participation by students was due to student centred strategies and student-oriented activities could produce positive thinking, information and knowledge (Lee, 2003).

In addition, the findings based on 19 student records, Student 3 and Student 24 showed that activity based on problem-solving task gave them a space to exchange answers and defend their arguments. According to Verdi, Crocks & White (2003) and Puacharearn & Fisher (2006) performed in the group activities enableb students to collaborate with others. In addition, teachers should encourage students through inquiry and encouraged students to question other students. Therefore, in the constructivist classroom the teacher must provided a challenging task according to students ability and provided space for discussion. Through discussion students had the opportunity to share their ideas to others. At the same time, students could build their knowledge (Walker-Tileska, 2000: Quale, 2005).

9. Conclusion

In conclusion, the use of CSAA Teaching Module contributed high level thinking skills among students. This module also enabled students to achieve better performance in examinations, particularly on the essay form. In addition, this module was also able to overcome learning problems such as lack of interest, concentration, skills in critical and creative thinking. This learning problem could be overcome by providing a conducive learning environment based on problem solving, working by pairs, the construction of concept maps and brainstorming. However, there were several constraints faced by teachers and students while using this method. Among the problem students did not doing their preparations, Teachers were still influenced by traditional teaching method and the learning environment are not conducive.

References

- Brady, B., & O'Regan, C. (2009). Meeting The Challenge of Doing an RCT Evaluation of Youth Mentoring in Ireland: A Journey in Mixed Methods. *Journal of Mixed Methods Research*, 3 (3), 265-280.
- Creswell, J. W., & Plano-Clark, V. L. (2012). *Designing and Conducting Mixed Method Research (3rd ed)*. London: Sage Publications.
- Gagnon, G. W., dan Collay, M. (2001). *Designing for Learning: Six Elements in Constructivist Classrooms*. California: Corwin Press.
- Lee, L. M. (2007). *The Construction of a Constructivist: Learning How to Teach Without Teaching*. Pulau Pinang: USM.
- Othman, M. A. (2007). *Keberkesanan Kaedah Pengajaran Berbantuan Komputer Di Kalangan Pelajar Pencapaian Akademik Rendah Bagi Mata Pelajaran Geografi Tingkatan 4 di Negeri Sembilan* (Doctoral Theses). Universiti Sains Malaysia. Pulau Pinang.
- Nik Pa, N. A. (1999). *Pendekatan Konstruktivisme Radikal dalam Pendidikan Matematik*. Kuala Lumpur: Universiti Malaya.
- Matanluk, O. (2011). *The Effectiveness of Using CSAA Module on Students Academic Performance*. Paper presented at 1st International Conference on World-Class Education (ICWED) on 5-6th, Dec, University of Malaya, Kuala Lumpur.
- Puacharearn, P., & Fisher, D. (2006). *An Inservice Teacher Training Process for Improving Constructivist Learning Environments in Thai Small School Classroom*. A Paper Presented at the Strengthening the Teacher Profession for the 21st Century, Thailand.
- Raman, A. (2006). *Kesan Peta Animasi Dan Interaktif Dalam Pengajaran Dan Pembelajaran Geografi* (Doctoral Theses). University Utara Malaysia, Kedah.
- Syed Abdullah, S. N. (2004). *Laporan Prestasi Calon Mata Pelajaran Geografi*. Kuala Lumpur: Majlis Peperiksaan Malaysia.
- Singer, F. M., & Moscovici, H. (2008). Teaching and learning cycles in a constructivist approach to instruction. *Journal Teaching and Teacher Education*, 24: 1613-1634.
- Steffe, L., & Gale, J. (ed.). (1995). *Constructivism in Education*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Nair, S., & Muthiah, M. (2005). Penggunaan Model Konstruktivisme Lima Fasa Needham Dalam Pembelajaran Sejarah. *Jurnal Pendidik dan Pendidikan*, Jil. 20, 21–41, 2005.
- Othman, M. A. (2007). *Keberkesanan Kaedah Pengajaran Berbantuan Komputer Di Kalangan Pelajar Pencapaian Akademik Rendah Bagi Mata Pelajaran Geografi Tingkatan 4 di Negeri Sembilan* (Doctoral Theses).Universiti Sains Malaysia, Pulau Pinang.
- Tobias, S., & Duffy, T. M. (2009). *Constructivist Instruction: Success or Failure?*. New York: Routledge.
- Treagust, R., Duit, R., & Fraser, J. (ed.). (1996). *Improving Teaching and Learning in Science and Mathematics*. New York: Teachers College Press.
- Verdi, M., Crocks, S. & White, D. (2003). Learning Effects Of Prints and Digital Geographic Maps. *Journal of Research on Technology in Education*, 35(2), 290-302.
- Von Glasersfeld, E. (2008). *Constructivism: The Theory, Perspectives and Practice*. London: The Falmer Press.
- Wan Hussin. W. R. (2002). *Persepsi Pelajar Terhadap Mata Pelajaran Geografi Di Sekolah Menengah Atas: Kajian Kes di Sekolah-Sekolah Terpilih Di Semenanjung Malaysia*. Pulau Pinang: Universiti Sains Malaysia.
- Walker-Tileska, D. (2000). *10 Best Teaching Practices: How Brain Work. Learning Styles And Standards Define Teaching Competencies*. New York: Corwin Press.