DEVELOPMENT AND IMPACT OF SCAFFOLDED MASTERY LEARNING MODULE ON CELL DIVISION AMONG FORM 4 LOW ACHIEVERS IN BUKIT MERTAJAM

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THESIS SUBMITTED IN FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTER OF EDUCATION (BIOLOGY)
(MASTER BY RESEARCH)

FACULTY OF SCIENCE AND MATHEMATICS
SULTAN IDRIS EDUCATION UNIVERSITY

2018

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

ABSTRACT

This study aimed to develop and determine impact of the Scaffolded Mastery Learning (ML) module (teacher and student) on Cell Division topic. The research utilized developmental and case study design. Sidek Module Development Model was employed to develop the modules. Three experts involved in module validity while 10 students were selected as respondent in the pilot study. The validity of the module calculated in percentage and Cronbach Alpha value was utilized to indicate reliability. Next, the modules were implemented in teaching and learning process (T&L) within six weeks. Purposive sampling technique was used in selecting 63 students as sample. The T&L process were observed and recorded. Students were divided into enrichment (29 mastered students) and remedial (34 non-mastered students) activities. In remedial activity, scaffolding techniques (verbal communication and reteach) were applied. Pre-and Post tests were conducted. Two teachers involved in semi- structured interview and 20 students from remedial activity selected for focus group interview. Descriptive statistic was used to calculate test scores. Audio and observation were transcribed and analysed to determine theme (thematic analysis). The developed modules obtained high validity (96%) and high reliability (α=0.90). From the interview by the respondents, the teacher module helped the teachers to improve the knowledge and understanding of Scaffolded ML, while students claimed that the module helped them to enrich their learning experience. In focus group interview, the respondents stated that the remedial activity helped them to master the content. This supported by the mean of Pre-test (67.08) and Post-test (90.23). However, the respondents in semi-structured interview claimed that time consumption is an impeding factor in implementing Scaffolded ML. In conclusion, Scaffolded ML module has enriched student learning experience. In implication, this research offered evidences that the module of Scaffolded ML in Cell Division has positive impact for form 4 low achievers.

PEMBANGUNAN DAN KESAN MODUL SCAFFOLDED PEMBELAJARAN MASTERI DALAM PEMBAHAGIAN SEL DALAM KALANGAN PELAJAR BERPRESTASI RENDAH TINGKATAN 4 DI BUKIT MERTAJAM

ABSTRAK

Kajian ini bertujuan untuk membangunkan dan menentukan kesan modul Scaffolded Pembelajaran Masteri (ML) (guru dan pelajar) bagi topik Pembahagian Sel. Kajian ini menggunakan reka bentuk pembangunan dan kajian kes. Model Pembangunan Modul Sidek digunakan untuk membangunkan modul-modul. Tiga pakar terlibat dalam kesahan modul manakala 10 pelajar telah dipilih sebagai respoden dalam kajian rintis. Kesahan modul dikira dalam peratusan dan nilai Cronbach Alpha digunakan untuk menunjukkan kebolehpercayaan. Seterusnya, modul-modul dilaksanakan dalam proses pengajaran dan pembelajaran (PdP) dalam tempoh enam minggu. Teknik pensampelan tujuan digunakan dalam memilih 63 pelajar sebagai sampel. Proses PdP telah diperhatikan dan direkod. Pelajar dibahagikan kepada aktiviti pengayaan (29 pelajar menguasai) dan pemulihan (34 pelajar tidak menguasai). Dalam aktiviti pemulihan, teknik-teknik "scaffolding" (komunikasi lisan dan mengajar semula) digunakan. Ujian Pra dan Pasca dijalankan. Dua guru terlibat dalam temu bual separa berstruktur dan 20 pelajar dari aktiviti pemulihan telah dipilih untuk temu bual kumpulan berfokus. Statistik deskriptif digunakan untuk mengira skor ujian. Audio dan pemerhatian ditranskripsi secara verbatim dan dianalisis untuk menentukan tema (analisis tematik). Modul-modul yang dibangunkan memperolehi kesahan yang tinggi (96%) dan kebolehpercayaan yang tinggi (α=0.90). Daripada temubual oleh responden, modul guru membantu guru-guru dalam meningkatkan pengetahuan dan pemahaman "Scaffolded ML" manakala pelajar menyatakan bahawa modul membantu memperkayakan pengalaman pembelajaran mereka. Dalam temu bual kumpulan berfokus, aktiviti pemulihan membantu mereka untuk menguasai kandungan. Hal ini disokong oleh min ujian Pra (67.08) dan Pasca (90.23). Walau bagaimanapun, responden dalam temu bual separa berstruktur menyatakan bahawa penggunaan masa adalah faktor penghalang dalam melaksanakan "Scaffolded ML". Kesimpulannya, modul dan pendekatan "Scaffolded ML" memperkayakan pengalaman pembelajaran pelajar. Implikasinya, kajian ini memberikan bukti-bukti bahawa modul "Scaffolded ML" dalam Pembahagian Sel memberikan kesan-kesan positif dalam kalangan pelajar berprestasi rendah tingkatan 4.

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LIST OF ABBREVIATION

ML	Mastery Learning
MCQ	Multiple Choice Question
RTA	Regular Teaching Approach
PAT	Physics Achievement Test
SMDM	Sidek Module Development Model
SSPS	*Statistical Package for the Social Sciences*
T&L	Teaching and Learning

APPENDIX LIST

CHAPTER 1

INTRODUCTION

1.1 Introduction

The goal of science education is to equip students with scientific knowledge and skills (Sadiah, 2008). This is to enable them to understand well about scientific phenomena as understood by scientists so that they can relate science with natural phenomena and everyday experiences. Deep understanding also enables humans to provide rational explanations based on their ability and intellectual ability in complex and diverse science phenomena. It can also create awareness about the importance of science phenomenon and its affects in life.

Secondary School New Curriculum (KBSM) is designed to provide students with science knowledge and skills to develop the power of scientific thinking and to cultivate pure values to enable them to understand and appreciate the science and its

applications in life. Despite many changes have occurred in the national education system, students' weakness in science is still ineffective (Sadiah, 2008).

Researchers, especially those who focus primarily on science education, stated that teaching method is one of the factors that influence success in a teaching and learning process. In the study of Musa (2010) teaching strategy is playing a role to help students in education. The effective teaching strategy can enhance the understanding and can avoid from misconception in their study. Teachers play a role to determine the right approach for each of their students. As we know, there are students who are clever and learn at faster rate and some are left behind in the lesson. These weak students should not be left behind but they should be given more guidance by the teacher.

Mastery Learning (ML) is a method that allows all students to master a topic before moving on to another topic. In addition, Guskey (2007) stated that in ML, the learning time needed by the students is longer compared in traditional teaching method. Teacher’s support is also very important in improving the weak student’s performance. This kind of support called scaffolding. Scaffolding refer to temporary support structures that put in place to assist students in accomplishing new tasks and concepts they could not typically achieve on their own (Guskey, 2007). Once students are able to complete or master the task, the scaffolding is gradually removed or fades away (Piper, 2005).

Students also have the right to succeed in the future. The beginning of schooling will determine the fate of students out there someday. If teachers and educational staff play their role to coordinate the distribution of student achievement, then the students will be succeeded in future. Hence, researchers have used a combination of scaffolding and ML to help weak students. The Scaffolded Mastery Learning is proposed by the researcher as an approach that will enhance the achievement of these weak students.

1.2 Problem Statement

Practice teaching and learning of science subjects in school in Malaysia has long been didactic (Sadiah, 2008). Didactic teaching characterized as lectures and exercises, memorization by students, no effort towards integrating informal experience with what was learned, no stimulation through questioning process, there is no opportunity for students to reject and doubt information and instruction too quickly because teachers need to spend a solid curriculum to enable assessment to be implemented. The characteristics of this teaching demonstrate the lack of space for the development of the thinking and the mastery of the student in a topic. It does not stimulate meaningful learning to students. This situation also causes teachers to not have time to plan and implement creative teaching to attract students (Sadiah, 2008).

Biology is not an easy topic for students to learn and most of them do not get high marks in this subject (Ruth, 2012). Biology is one of the subdivisions of the science. Biology is the study of living things from familiar, complex multicellular

organisms that live in the many different habitats of our biosphere to single celled micro-organisms. Biology involves the description of the complex dynamical system that reaches from the highest level of organisms to the level of molecular. This means that the students need to master small concepts and must be able to see the relationship between these concepts if they want to describe a phenomenon or process in biology (Ruth, 2012).

Students are still weak in drafting concepts and facts well and systematically. These weaknesses make it difficult for students to explain the meaning of some phenomena. In addition, this clearly illustrates the weaknesses in which students are weak in identifying the similarities and differences between biological structures or biological processes in animals and plants. (Ruth, 2012).

Furthermore, the difficulty of students in studying biological concepts has been studied by Tekkaya, Ozkan and Sungur (2001). In their study, most students face difficulty in learning concepts and it shows that cell division is one of the most difficult and important topics for students. The terminology and the abstract concepts is the main difficulties among the students. The students always mix with these terms especially genes and allele due to a very complicated terminology and numerous terms derived from foreign languages such as chromosomes, genes, alleles, chromatids and DNA. Thus, they generally memorize these concepts and forget about it after some time.

On the other hand, research on student's conceptual understanding often indicates that even after being taught students used to be misconceptions of scientific concepts (Yesilyurt & Kara, 2007). The reasons for this misunderstanding include the student's inability to distinguish between replicating, synapsis, and disjunction, and determining whether or not these processes take place in mitosis, meiosis, or both. Further mistakes include lack of understanding of basic terms that the students confused about chromatids and chromosomes, or chromosomes connected with unobstructed chromosomes, and others (Kindfield, 1994). This is a concern for teachers because the process of cell division is fundamental to understanding the growth, development, reproduction and genetic.

Inadequate mastery of subject knowledge and imprecise use of terminology mainly contributed to the problem of serious misunderstandings in mitosis and meiosis among students. In the study of Bahar and Hansell in 1999, the confusion of mitosis and meiosis is caused by their similarity and the teacher was teaching them side by side. In addition, Chattopadhyay (2012) also stated the same problem faced by the students which is misunderstanding of mitosis and meiosis as these two topics are taught side by side. This misunderstanding caused by students and ineffective learning or poor teaching in the classroom. A large number of misconceptions may have been caused by the personal experiences of the learners (Yip, 1998). Particularly those topic that are concerned with more complex or abstract phenomena such as cell division, most students are less likely to come into immediate and direct contact with them in daily life. Then, the students have little chance to develop their own 'naive' explanations about the topic (Lawson, 1988).

According to Chattopadhyay (2012), these errors are mainly caused by ineffective learning or poor teaching in the classroom and Chattopadhyay (2012) asserted that cell division was not well taught by teachers in school and this has led to the confusion and misunderstanding of students. They suggested that a review should be done on the least teaching methodology at higher education to provide a teaching community to teach this particular subject.

Based on these aforementioned problems such as the lack of space for the development of the thinking and the mastery of the student in a topic, weak in drafting concepts and facts well and systematically, the difficulty of students in studying biological concepts, inadequate mastery of subject knowledge and imprecise use of terminology, misconceptions of scientific concepts and ineffective learning or poor teaching in the classroom the researcher aim at addressing those issues research objectives and research question that are both focusing on developing an innovative teaching and learning (T&L) module and gauging how it impact students and teachers during T&L Process. The following subchapters state the objectives and questions related to this research.

1.3 Research Objectives

In this study, the researcher has identified five research objectives. The objectives of this study include:

1. To develop Scaffolded ML modules (for teachers and students) for Cell Division topic.

2. To determine the impacts of Scaffolded ML module for Cell Division topic towards teachers.
3. To determine the impacts of Scaffolded ML module for Cell Division towards students.
4. To determine teachers' perceptions towards Scaffolded ML implementation.
5. To determine the impacts of Scaffolded ML approach on students.

1.4 Research Questions

Following the research objectives, the research strives to answer those following questions:

1. What are the contents of Scaffolded ML approach in Cell Division module?
2. What are the impacts of Scaffolded ML module in Cell Division topic towards teachers?
3. What are impacts of Scaffolded ML module in Cell Division topic towards students?
4. What are the teacher's perceptions towards Scaffolded ML implementation?
5. What are the impacts of remedial activity in Scaffolded ML approach on students?

1.5 Theoretical Framework

This section will discuss the theoretical framework that becomes the basis of this study. Researcher used Vygotsky's in the study of Verenikina (2003) sociocultural theory and Bloom (1968) theory to explain how meaningful learning is achieved. The student learning affected by learning time, quality of instructions and scaffolding (any assistance or support to help student in the learning process). All of these will affect the learning outcomes which is the level of student's achievement. The combination of Lev Vygotsky's Sociocultural Theory and Bloom Mastery Learning Theory used for this study. The Lev Vygotsky's Sociocultural Theory focused more on scaffolding part while Bloom Mastery Learning Theory explained about the learning time and quality of instructions that effected the level of student achievement. The details of the theories used explained in the next subtopic.

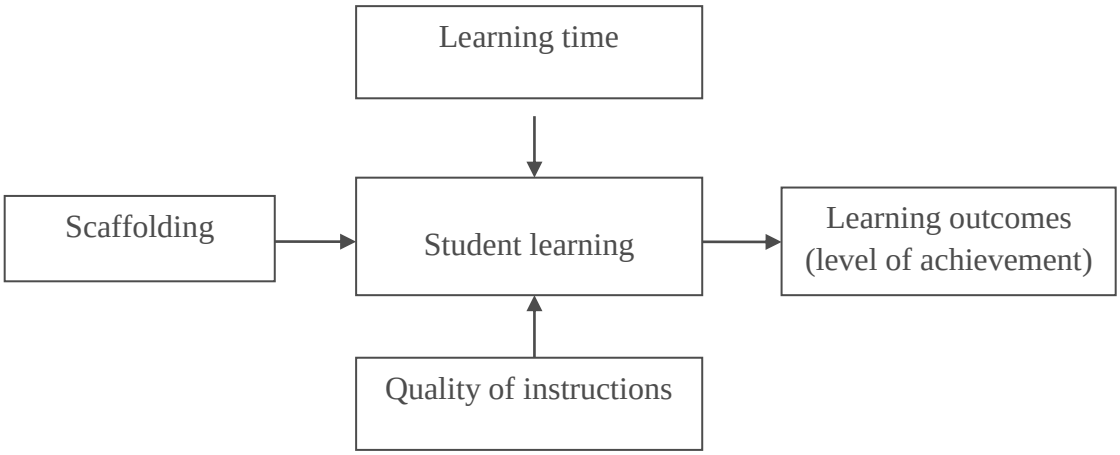

Figure 1.1. Theoretical Framework

1.5.1 Lev Vygotsky's Sociocultural Theory

Social theory of Lev Vygotsky in the study of Verenikina (2003) suggests that social interaction plays an important role in the development of cognition. Verenikina (2003) said that Vygotsky theorized that learning takes place through participation in embedded socio-cultural experiences. In Vygotsky's view, students do not study separately. Instead learning is largely influenced by social interactions, which take place in meaningful contexts. Children's social interactions with others who are more knowledgeable or capable and of their environment have a significant impact on the way they think and interpret the situation. A child develops his intelligence through the application of concepts based on his own interpretation of an activity that takes place in a social atmosphere.

Communication that occurs in this setting with more knowledgeable people such as parents, teachers, peers and others help children build understanding of the concept (Bransford, Brown, & Cocking, 2000). Communication helps children develop internal or egocentric speech. Internal speech abbreviated for self-direction that ultimately directs personal cognitive activities. Internal speech developed as adults initially modelled cognitive processes and presented steps such as "think-hard" modelling. From time to time and through repeated experiences, children begin to internalize and are responsible for dialogue action that is a "private greeting" spoken strongly by children to direct personal cognitive activities. Modelling and guidance provided by more knowledgeable people will be reduced until the child can complete the activity without this support or scaffolding, then the child's inner utterance will now direct the child's activities.

1.5.2 Bloom Mastery Learning Theory

The theory of Mastery Learning Benjamin Bloom is derived from Carroll model of school learning. Bloom (1968) transforms this model into an effective working model for mastery learning. Bloom in 1968 states that if ordinary students are distributed about talent for the subject and if they are given quality instruction and adequate time for learning, the achievement of the subject settlement will be distributed normally. This Bloom's idea is based on the fact that if every student receives an optimal teaching quality and learning time is required, the majority of students will be able to achieve the level of mastery. Bloom condemns the situation where teachers are expecting that some students will succeed and some will not. In the mastery learning, Bloom suggests that all or almost all learners can master what is taught (Bloom, 1968).

It recommends procedures where student instruction can be managed to promote full development. It differs from conventional class instruction as it emphasizes the mastery of all objectives in each learning unit, using diagnostic progress tests (formative tests) to identify each student's error and use systematic feedback to help students overcome learning difficulties and eventually provide additional time for students who need them and allow variations in learning time and emphasize high level of achievement for all students. On the other side, Bloom (1968) theorized that ML led to the appropriate use of systematic teaching designs in achieving teaching goals.

This approach uses referenced criteria rather than norms through correction feedback and enrichment activities. Feedback along with recovery activities is based on a variety of clear small units and sequences of guidelines and outcomes. Bloom's (1968) theory emphasizes the mastery of all objectives in each learning unit, using diagnostic progress tests (formative tests) to identify each student's error and use systematic feedback such as correcting to help students overcome learning difficulties and ultimately provide additional time for those who need them. Besides, it also allows diversity in learning time and emphasize high level of achievement for all students (Obidiegwu & Ajibare, 2007).

In addition, based on Guskey (2007) with feedback and corrective information obtained from formative evaluations, each student has a detailed prescription of what needs to be done to master the concept or skills of the unit. This mere correction prevents small learning difficulties from accumulating and becomes a major learning problem. It also gives teachers a practical way to change and differentiate their directions in order to meet the individual learning needs of the students. As a result, more students learn better and master the essential learning goals in each unit and get the necessary prerequisites to succeed in the next units.

1.6 Operational Definition

In this study, there are several main terms used and serve as the pillars of the study. The terms are mastery learning, scaffolding, scaffolded mastery learning, achievement, low achiever, quality of instruction, learning time and brainstorm

worksheet. Each and every main term involved in this study are defined scientifically whereby the definition of the terms are derived from the previous researchers. In addition, these terms are defined operationally whereby the terms defined specifically for this research context.

Mastery Learning- Mastery learning is a method of instruction where the focus is on the role of feedback in learning. Feedback is always a part of mastery learning where students are given an opportunity to practice what they have learned and are given corrective feedback (Motamedi & Sumrall, 2000). The mastery learning method divides subject matter into units that have predetermined objectives or unit expectations. Students, alone or in groups, work through each unit in an organized fashion. Students must demonstrate mastery on unit exams, typically 80%, before moving on to new material. Students who do not achieve mastery receive remediation through tutoring, peer monitoring, small group discussions, or additional homework. Additional time for learning is prescribed for those requiring remediation. Students continue the cycle of studying and testing until mastery is met (Davis & Sorrell, 1995).

Scaffolding- Scaffolding is the instruction used as a type of assistance to enhance the student's achievement (Verenikina,2008). Scaffolding is an approach to course and assignment design that involves breaking the learning objectives into manageable steps, and providing instructor support throughout the learning process (Skene & Fedko, 2014)