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ANALYSING THE COGNITIVE ABILITIES OF FORM 5 STUDENTS IN LEARNING BIOLOGY THROUGH HERMENEUTICS PEDAGOGIC

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DISSERTATION SUBMITTED IN FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTER OF EDUCATION PSYCHOLOGY (MASTER BY RESEARCH)

FACULTY OF EDUCATION AND HUMAN DEVELOPMENT UNIVERSITI PENDIDIKAN SULTAN IDRIS

2014

UNIVERSITI PENDIDIKAN SULTAN IDRIS UNIVERSITI PENDIDIKAN SULTAN IDRIS UNIVERSITI PENDID ABSTRACT N IDRIS UNIVERSITI PENDIDIKAN SULTAN IDRIS UNIVERSITI PENDIDIKAN SULTAN IDRIS UNIVERSITI F

The purpose of this study was to examine the Form 5 students' experiences using their cognitive abilities in learning Biology accordance with the Paper 1 (Objective), Paper 2 (Structured & Essay), and Paper 3 (Written Practical). This study employed Hermeneutics pedagogic method, i.e the method that deals with text interpretation to understand the text. The distribution of research questionnaires was employed randomly to 57 of Form 5 science stream students in 2 different schools in Taiping. The Hermeneutics pedagogic method was used in order to interpret the students' written texts on the students' cognitive abilities of learning Biology and categorized the cognitive abilities into a few main learning ways for the 3 papers. The findings of the study indicated that the main learning ways for acquire the knowledge of Biology for Paper 1 (Objective), Paper 2 (Structured & Essay), and Paper 3 (Written Practical) were answering techniques, i. e. provide answer points based on marks allocated with explanation and examples of the points, exercises on SPM model questions, past year questions, trial questions, and spot questions, revision by referring to text books and reference books, initiatives in searching information in internet, newspapers, and educational website, and learning styles, i. e. visual type like to make colorful notes and mind maps, auditory type prefer to have discussion and listen attentively in class, and kinesthetic type love to write notes and draw diagrams. In short, the cognitive abilities had managed to enhance the students' effectiveness in learning Biology and at the same time helped the students to be more positive in acquiring knowledge of learning Biology.

Menganalisis Keupayaan Kognitif Pelajar Tingkatan 5 dalam Mempelajari Biologi Melalui Kaedah Pedagogi Hermeneutik

Tujuan kajian ini adalah untuk mengkaji pengalaman pelajar menggunakan keupayaan kognitif mereka dalam mempelajari Biologi bersesuaian dengan Kertas 1 (Objektif), Kertas 2 (Struktur & Esei) dan Kertas 3 (Praktikal Bertulis). Kajian ini menggunakan kaedah pedagogi hermeneutik, iaitu kaedah yang melibatkan pentafsiran teks untuk memahami teks tersebut. Pengedaran soal selidik dilakukan secara rawak terhadap 57 orang pelajar Tingkatan 5 aliran sains di 2 buah sekolah di Taiping. Kaedah pedagogi hermeneutik digunakan bagi mentafsir teks bertulis pelajar mengenai keupayaan kognitif pelajar mempelajari Biologi dan mengkategorikan keupayaan kognitif tersebut kepada beberapa cara pembelajaran utama bagi ketiga-tiga kertas. Dapatan bagi kajian ini menunjukkan bahawa cara pembelajaran utama untuk memperoleh pengetahuan Biologi bagi Kertas 1 (Objektif), Kertas 2 (Struktur & Esei) dan Kertas 3 (Praktikal Bertulis) adalah teknik menjawab, iaitu memberikan isi jawapan berdasarkan markah yang diperuntukkan berserta penjelasan dan contoh bagi isi jawapan tersebut, latihan dalam soalan model SPM, soalan tahun-tahun lepas, soalan percubaan dan soalan ramalan, ulangkaji dengan merujuk kepada buku teks dan buku rujukan, inisiatif dalam mencari maklumat di internet, surat khabar dan laman web pendidikan dan gaya belajar, iaitu jenis visual suka membuat nota berwarna-warni dan peta minda, jenis auditori lebih suka membuat perbincangan dan menumpukan perhatian di dalam kelas dan jenis kinestetik, iaitu suka menulis nota dan melukis gambar rajah. Secara ringkas, keupayaan kognitif dapat meningkatkan keberkesanan pelajar dalam mempelajari Biologi dan pada masa yang sama membantu para pelajar untuk menjadi lebih positif dalam memperoleh pengetahuan mempelajari Biologi.

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DOK	Depth of Knowledge
ICPS	Integrated Curriculum for Primary Schools
ICSS	Integrated Curriculum for Secondary Schools
PISA	Programme for International Student Assessment
SPM	Sijil Pelajaran Malaysia
STI	Science, Technology, and Innovation

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CHAPTER 1

INTRODUCTION

1.0 Introduction

This chapter discusses the background of study in the first section and will continue with the problem statement and research objectives. Then, the research questions, conceptual and theoritical framework, the significance of the study, limitation and scope, and operational definition of terms used in this study also been discussed.

Cognitive ability (equivalent to cognitive competence) comprises of the ability to think (intelligence), knowledge (true and relevant knowledge) and the intelligent use of this knowledge (Rindermann, 2012). The cognitive thinking is most essential for students

in educational aspects. All-round skills, thinking skills, cognitive, psychomotor, and N IDRIS UNIVERSITI PENDIDIKAN SULTAN IDRIS UNIVERSITI PENDIDIKAN SULT

The importance of learning science had been included in the Eighth Malaysian Plan, whereby efforts were focused on strengthening science and technology's (S&T) capability, capacity to support productivity driven growth and improve competitiveness. In the Integrated Curriculum for Secondary Schools (ICSS), Biology was designed to prepare students to study Biology in depth and so as to enable them to be in various training and career-oriented in sciences and technology. The curriculum is also aimed at producing students who had the understanding of the biological control of scientific thought and moral values (Ministry of Education Malaysia, 2006). However, Biology was identified as one of the toughest subjects to score in *Sijil Pelajaran Malaysia* (SPM). For the past several years, the result in Biology showed the lowest number of students who passed the subject compared to the passes in Physics and Chemistry subjects (Ministry of Education Malaysia, 2012).

The above clearly showed that Malaysia through the Ministry of Education and other individuals regarded science education especially Biology and cognitive abilities as important components for country development especially in economy and educational growth. Thus, it was considered to seek the experiences of Form 5 students in using their cognitive abilities in learning Biology so that this initiative would be able to help the other low-achieving students to also score well in this subject.

1.1 Background of study

The science stream is much tougher compared with the humanities, arts, and vocational. The claims of science for inclusion in the school curriculum came to be recognized after years of active and persistent efforts. In contrast, other subjects were taught because they could provide a liberal education (Prakash, 2011). Biology had been identified as one of the most difficult subjects to score in SPM for the past several years. *Sijil Pelajaran Malaysia (SPM)* is the national examination of Malaysia that must be taken by Form 5 students in secondary schools (Ministry of Education Malaysia, 2001). This important examination determines and measures the students' abilities of learning and also as the benchmark for students to further their studies.

Biology is defined as the science of life and living organisms, deals with the human body as well as many other aspects of everyday life (Why study human and social Biology, 2009). There can be no doubt about the importance of Biology and the reasons for studying it at school. Because of this knowledge, mankind is able to understand better the world's biological lives and their processes. Teaching and learning of Biology need to be emphasized on students' involvement to actively promote the formation of analytical, critical and creative thinking (Hiong & Kamisah, 2013). Various activities which centered on the students were encouraged be included in laboratory work, field research, case studies, and simulation projects. Nowadays, science-related career is popular because in this era of modern technology, the need for skilled people in science is highly demanded. Biology is an important subject for admission to the best higher education

institutions in Malaysia. Many science courses offered by universities must have at least a pass in Biology as a mandatory requirement. Students who had taken Biology as their elective pure science subject would later take up careers in the field of science and technology and play a leading role in this field for national development (Ministry of Education Malaysia, 2006).

From the experiences and skills of Form 5 students in using their cognitive abilities in learning Biology, the researcher hoped to acquire the knowledge of the cognitive abilities involved. This was aimed at helping and providing guidance to the weak students to enhance their skills and score well in their examination. Modern psychological theory viewed cognitive abilities as multidimensional as many different abilities which were positively correlated: Some people were better at solving problems verbally while others were excellent at solving problems that involve visualization. Some students obviously and consistently understood new concepts quicker, solve unfamiliar problems faster, see relationships that others do not and were more knowledgeable about a wider range of topics than others (Reynolds, 2009). The art of interpretation involved in Hermeneutics pedagogic analysis was most appropriate to gain better understanding of experiences phenomenon. Ramakrishnan, Yahya, & Subramanian (2011) explained that interpretation was the abilities of fitting observed percepts into recognized paradigms, thereby deriving meaning, which was nothing more than the association of concepts. Interpretation applied to all aspects of the perceptual realm. Ramakrishnan et al. (2011) added Hermeneutics can therefore serve as a strategy to address a broad range of research questions. Zweck (2008) stated every sentence that has been communicated can be

understood only from its context or situation. This is also true of their content. This research explored the rationale for using Hermeneutics pedagogic to explore the cognitive abilities of participants involved in the learning of Biology. It also hope to demonstrate the flexibility and utility of Hermeneutics pedagogic for gathering and interpreting information from the sources. In addition, this study provided a review of essential Hermeneutics constructs and their application within this project.

1.2 Problem statement

In the statistical analysis of the percentage of students that passed in the Biology in 2011, the Biology analysis result showed 101,526 out of 259,300 (39.2%) candidates passed (Ministry of Education Malaysia, 2012). The percentage was the lowest scored compared to the other science subjects such as Chemistry which showed 131,145 out of 259,300 (50.6%) candidates passed and Physics showed 126,429 out of 259,300 (48.8%) candidates who passed. The analysis of SPM 2012 result of MRSM students in Biology also been reported decreased (Secondary Education Division of MARA, 2013). In the SPM 2003 examination, it was reported that candidates who sat for Biology performed poorly in answering questions about the test constructs of science process skills and applications and this caused candidates to answer based on logic and not scientific fact (Malaysia Examination Board, 2004). With a solid curriculum content and didactic delivery methods in schools, the students learned Biology solely for the purpose of passing examinations only. This method also led students to become bored and did not

appreciate their knowledge of Biology as it related to life since the learning process that did not mean anything and thus was likely to contribute to the negative impact of student interest in Biology subsequently affecting their performance in SPM. Meanwhile, in SPM 2007 the overall performance of the candidate was at a moderate level (Malaysia Examination Board, 2008). The SPM 2007 Performance Report explained that students were poor in science because they did not understand the concept well and the terminology used. They were also not able to define and explain the term given, hence affecting candidates' score and reflected that 50% of students were still weak in Biology. Candidates also lacked the knowledge and maturity in presenting the facts and concepts, mastering terminology and the science process skills of Biology.

In 2010 Malaysia joined the Programme for International Student Assessment (PISA) and the results showed that Malaysian students gained lower score in science (Hiong & Kamisah, 2013). This lower score was due to a deficit of higher order thinking skills in the education system as a whole (Ministry of Education Malaysia, 2012). Students need to adopt science process skills, critical and creative thinking skills in accordance with the requirements of examination questions to score an excellent result. Cognitive abilities such as perceptual and manual skills are very important in learning Biology. Generally, the predictive value of perceptual abilities and manual skills tests in Biology concepts involving dentistry had been less than the cognitive achievements (Ministry of Higher Education Malaysia, 2010). Therefore, assessments should aim at allowing the students to demonstrate their highest level of performance and competency in applying their knowledge, skills, and their personal qualities.

According to Ministry of Education Malaysia (2010), the importance of cognitive abilities was implemented to students since pre-school through respective learning areas such as cognitive development, language and communication, socio-emotional, physical, spiritual and moral, aesthetic and creative. Biology is the most important element in forming an essential part of the curriculum as it is the only subject which affords knowledge of certain facts and laws and helps in achieving the main objective of education (Ministry of Education, 2006). There are many topics covered in students' learning from Form 4 to Form 5 that will examine in SPM. The difficulties in understanding the Biology subject itself had been identified as one of the main causes of this phenomenon. It is hard to understand how the processes in science of life and organisms happen based on the theory that was already determined by the previous biologists. Each unit in the theory course carried suggestions for practical integration into the chapters in the textbook such as the rationale for doing them was evident and the understanding gained from them would help in furthering the understanding of the concepts (Biology (Classes XI - XII), 2010). Students were required to master all the topics covered from Form 4 to Form 5 because all the topics had the possibility to be examined. Noor, Zamri and Zahara (2012) stated that the assessment in education was not just for the right answer, but extended to the related thoughts with the concept. Students need abilities in learning Biology to develop knowledge of bio-science and skills of science inquiry, the values and attributes that will help them to consider issues and implications associated with the application of biological techniques and technologies (Ministry of Education, 2006).

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Kamisah, 2013). Fragmented T and L methods limit the delivery of abstract and complex biological concepts. Biology teachers were still applying traditional and out-dated methods in teaching Biology in conveying Biology facts directly to the students and encouraged rote memorization of the factual knowledge for examination. It was important to explore the cognitive abilities involved in learning Biology that could help the students better understand and enhance their abilities to answer well in Biology. Such study however had yet to be explored seriously. Hence, the researcher's intent to acquire and interpret the experiences of students in learning Biology. All subjects required students to understand their learning so that they might be able to develop strategies to emphasize their strengths. Effective learning in Biology was to apply the knowledge to the fullest with strong understanding (Huang & Nusbaum, 2006). It was usually more efficient to assess the application of knowledge for a higher level of functioning and thinking than by simply knowing something (Ministry of Higher Education Malaysia, 2010). The memory load will extend into long-term memory and increase its capacity to be loaded by deep understanding and keep rehearsing on learning (Reisberg, 2013).



Figure 1.1. Requirements of cognitive construct for Paper 1, Paper 2, and Paper 3 in Sijil Pelajaran Malaysia (SPM), Biology.

SPM Biology consisted of three papers namely; Paper 1, 4551/1, Paper 2, 4551/2, ¹ Pendid and Paper 3, 4551/3. Paper 1, Biology consisted of objective items, Paper 2 and Paper 3 consist of subjective items comprising of structured and essay question in Paper 2, and written practical in Paper 3. As shown in Figure 1.1, the level of difficulties is identified in the Biology Paper 2 and Paper 3. In Paper 2, requirements of cognitive construct is the highest compared with the Paper 1 and Paper 3. Beside involve knowledge, understanding, and application, it was also involved the analyzing, synthesizing, and evaluating skills which required higher mental abilities. In Paper 1, the requirements of construct needed only the knowledge, understanding and application, and in the Paper 3, having scientific skills would be advantageous to the students. The higher the level of performance that could be assessed, the more valid and useful the assessment would be. Thus, to score well in the Biology, the students must acquire these cognitive constructs by applying the right cognitive abilities. Hamdan, Wahida, Tang, and Suan (2011) also stated that in order to score well in Biology, students needed the thinking skills on how to handle the questions.

The number of students in science stream had reportedly been on the decline. The policy of 60 (science): 40 (art) seems to be impossible as students' inclination towards the science subject is still relatively low as since 2007 only 29% of secondary and tertiary students had enrolled into science streams students (Hiong & Kamisah, 2013). Hence, effective ways should be developed in order to increase the number of students in science stream to achieve the target. Scoring excellent result in Biology also allows them to follow critical subjects in universities. In the process of becoming a developed country

through Vision 2020, Malaysia needed a higher number of workforces who were qualified in specific fields. Given in the above, Hermeneutics pedagogic was used to interpret the understanding from the perspectives of students in order to make sense of the situations of learning Biology. A premise of Hermeneutics was that people were selfinterpreting and were therefore engaged in the abilities to understand what is important and real for them in order to create their own construct of reality of acculturation experiences (Zweck, 2008).

1.3 Research objectives

1.3.1 General objective

To analyse Form 5 students experiences in using their cognitive abilities in learning Biology.

1.3.2 Specific objective

To analyse ways of learning Biology of Form 5 students according to examination Paper

1 (Objective), Paper 2 (Subjective and Essay), and Paper 3 (Written Practical).

The research's questions of the present study examine the cognitive abilities of Form 5 students in learning Biology through Hermeneutics pedagogic as follows:

- a) What were the learning ways of Form 5 students in Paper 1 (Objective), Biology?
- b) What were the learning ways of Form 5 students in Paper 2 (Structured and Essay), Biology?
- c) What were the learning ways of Form 5 students in Paper 3 (Written Practical), Biology?

1.5 Conceptual and theoritical framework

Figure 1.2 shows the conceptual framework of this study constructed by the researcher which involved input, Hermeneutics pedagogic and output. Input stage would involve the primary part of getting data from Form 5 students. Then, through interpretation, the learning ways in Biology Paper 1, Paper 2, and Paper 3 to get the output data: cognitive abilities (set in Biology exam papers and acquired from students).



