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Potential of Interactive Multimedia Learning Courseware using three different strategies in the learning of biology for Matriculation students in Malaysia

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Abstract

This paper discusses the implementation of an Interactive Multimedia Learning Courseware (IMLC) in enhancing the learning of biology among Matriculation students in Malaysia. A qualitative method using unstructured interviews and observation has been selected as a technique for gathering information in order to identify the current problem faced by students with regard to succeeding in biology, and the need for any new instructional strategies. Ten respondents of varying academic ability were identified from two Matriculation colleges to participate in this interview. The findings of this preliminary investigation confirm that current Matriculation students do face problems in the learning of biology. The results reveal that there is a lack of good quality learning materials for them to depend on. In addition, limited time for revision and for exploring each topic is also a problem which will have to be solved to enhance their performance in the subject of biology. In conclusion, the implementation of IMLC with different learning strategies needs to be designed and developed to facilitate and enhance the learning ability of students in terms of the subject of biology.

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1. Introduction

Biology, as a discipline, has a bright future. It is integral, not only among the sciences, but also in the daily activities of human beings in general. However, biology has been documented as a difficult subject, and biology courses are generally taught at a level of abstraction (Brown et al., 2009). The abstract knowledge of biology is said to have an influence on the learning difficulties of students. Learning biology imposes great demands on students and lecturers, whereby instructors often have to use analogies, concept maps, mathematical formulae, biological symbols and scientific measurement simultaneously to illustrate the non-visible scenario in biology.

In Malaysia, the analysis on the performance of Malaysian Higher School Certificate students (STPM- Sijil Tinggi Pelajaran Malaysia) between 2005 and 2010 concluded that the performance in biology has decreased and is unstable (Malaysia Examination Council, 2011). Through the researchers’ experience of having taught biology at matriculation level over an eight year period, the inconsistencies in terms of student performance in the biology examination indicated that most pre-university level students have the same learning problem. These results indicated that nowadays something adverse was happening with regard to the students’ biology learning process and

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needed to be investigated in some depth. Therefore the teaching and learning of biology should be improved in order to ensure a better understanding for all in terms of biology concepts. To overcome this problem, various interventions have been suggested by educators. Unfortunately, most of these interventions require the use of scarce resources such as additional time and effort on the part of lecturers. However, the advent of Information and Communication Technology (ICT) in the last few years has decreased the burden on the resources needed to support the teaching and learning process. The utilization of the computer as ubiquitous teaching tool has become very prevalent in Malaysian schools and in the educational sector overall. As a result, the use of computers in combination with effective learning strategies has tremendous potential in the teaching and learning process.

2. Findings

The findings below are based on our literature review and on the preliminary investigation through observation and interviews.

A. Literature review

The Matriculation Programme of the Ministry of Education is a one or two-year pre-university preparatory programme intended for bumi putera students in order for them to qualify for degree courses in science, technology and accounting at Higher Education Institutions, locally or overseas. Students with good results in the Malaysian Certificate of Education (SPM-Sijil Pelajaran Malaysia) can enter this programme. Starting in 2005, the selection process for the programme is done through a merit entry and race-based quota system, whereby 90% of the places are reserved for bumi putera students, while the remaining 10% are open for non-bumi puteras. Prior to 2006, only the one-year programme was being offered. Since then, four different programmes have been offered. They are the One Year Programme (PST, Program Satu Tahun), the Two Year Programme (PDT, Program Dua Tahun), the technical and the accounting programme. Mathematics, physics, biology and chemistry are compulsory subjects. Other compulsory subjects are English, Dynamics Skills (Kemahiran Dinamika), Islamic or Moral Study and Information Technology. Students are also required to take a curricular activity of their choice, such as sports or games, societies or clubs or marching band during the programme. Therefore, the curriculum for these programmes emphasises both academic and non-academic aspects. In turn, this will help groom students by providing them with knowledge and a high degree of social skills as well as being able to exhibit admirable characteristics and leadership skills.

Biology is one of the subjects offered as part of the Matriculation science programme. This subject contains many abstract concepts that are difficult to understand. Students must be able to conceptualise and construct abstract concepts in biology in order to understand and make sense of it. Many students’ common misconceptions concerning biology include their understanding of topics such as respiration, photosynthesis, ecology, genetic, classification, and the human circulatory system (Tekkaya, 2002). It is important to design an excellent instructional system to enhance the teaching and learning of difficult and abstract topics as part of the subject of biology.

In Malaysia, there have been only a few local pieces of research conducted on the Matriculation programme. Research by Syed Anwar Aly (2000) revealed that performance in science subjects for the SPM and Matriculation levels is worrying. In addition, the academic performance of Matriculation students is only at the average level (IPPTN, 2004). This problem has resulted in low academic performance when these Matriculation students enter institutions of higher education when compared to students who enter the institutions after STPM. The Matriculation level lecturers play an important role in the performance of Matriculation students. The professional knowledge of the lecturers and how they deliver such knowledge are the aspects that have the main impact on student achievement (Nooraida & Rabiatal Adawiyah, 2010). The teaching method used has an effect on the students’ performance and academic achievement. Therefore, new teaching and learning strategies should be implemented by lecturers to avoid misconceptions in the learning process (Sadiyah, 2008). As a result, teaching and learning strategies, especially for science subjects, should be revised and studied. This should be done to ensure that any new interventions administered by lecturers are effective, and lead to a marked improvement in student performance.

B. Interviews
Ten students from two Matriculation Colleges were interviewed. These interviews confirmed that the strategies used in the learning of biology should be revised and improved to enhance the students’ performance. They also confirmed that there is a lack of good and powerful instructional teaching strategies employed by their lecturers. Most students fail to enjoy the classroom sessions, whether they consist of practicals, tutorials or lectures, and thus fail to understand biological concepts well. As a result they may ask for help from their friends who are having the same problem, and discuss it with them. This often leads to misunderstanding and misconceptions on the part of the students.

Most of the respondents admitted that they do not have enough time to do revision and explore each topic comprehensively, because of the heavy workload from other subjects. Besides, the syllabus is packed and the learning process is nonstop. As a result, feedback from the respondents alluded to the fact that the students’ focus in learning biology leads to stress. Ineffective and inefficient learning materials also add to the problem in learning biology. They stated that the lecture notes were sometimes incomplete in terms of elaborations of the terms and processes involved. Sometimes the diagrams or charts that their lecturer gave them were not clear. Thus the students had to put in more effort to do research for more information to complete their notes, with only a limited time available. Furthermore, from the researcher’s point of view as an experienced biology lecturer at one of the Matriculation colleges, the cramped syllabus that the lecturer has to complete within the allotted time causes the students to become depressed and therefore means that they cannot perform well in their examination.

In sum, the responses from these Matriculation students reflect the fact that biology is viewed as a difficult and abstract subject with formal concepts. Therefore it would be very appropriate to design and develop an IMLC that can enable them to learn the biological concepts in a rich and meaningful manner. All the interview respondents admitted that a new strategy in terms of applying the IMLC would help them to be more focused and understand better and faster, compared to the use of traditional instruction. They agreed that multimedia is a powerful medium that could enhance their understanding of abstract concepts in biology. Hence, to overcome the problems mentioned above, the researchers tried to develop a powerful IMLC for the subject of biology within the matriculation syllabus by applying three learning strategies, namely Computer-assisted Mastery Learning (CML), Computer-assisted Cooperative Learning (CCL) and Computer-assisted Cooperative Mastery Learning (CCML).

3. Learning theories and model

A. Mastery Learning

Mastery learning plays an important role in fostering students’ understanding of basic concepts of mathematical topics. Consequently, this approach meets the standards necessary in the learning of biology. It also provides systematic instruction that promotes meaningful and efficient processing of the information by the students (Figure 1).

![Figure 1. The Process of instruction under mastery learning (Guskey, 1997).](image)

B. Cooperative Learning

Cooperative learning had been developed so that small groups of students can work together in a structured way to solve academic tasks in any given period of time (Cooper, 1990). Cooperative skills are emphasized once the groups and tasks were structured. It was important to structure the activities so that every student could be both a teacher and a learner as a way of challenging rigid notions in which some students give help or need help. Also, it was important to create a classroom space for students to proudly explain the contents they had learned, while also
being able to seek help without fear, embarrassment, humiliation or isolation. Thus, a student’s difficulties become a group's liability. Furthermore, a structured social environment is provided in order to develop students’ skills and attitudes, that requires interaction across perceived differences and disabilities.

C. Mastery Cooperative Learning

Guskey (1997) proposed the use of cooperative mastery learning to foster students’ understanding within the teaching and learning process. Cooperative learning and mastery learning have been used effectively in various classroom contexts. These two types of learning are apparent because they clearly focus on different aspects of the teaching and learning process. Nonetheless, they share several common premises that contribute to their complementary nature and enhanced mutual implementation.

Currently, cooperative learning and mastery learning are two of the most commonly used learning strategies, and focus on different aspects of the teaching and learning process (Guskey, 1989). Since both strategies require the assessment of student learning to be criterion referenced, learning is not competitive. Both strategies emphasize the teacher’s role as a facilitator, by working closely with students to accomplish the students’ learning goals. At the same time, these strategies are flexible in their application. Lastly, cooperative learning and mastery learning have been found to yield positive results in many studies (Atkinsola, 1996; Guskey, 2010).

D. The e-Learning Model by Mayer

Clark and Mayer (2003) introduced a course of instruction delivered on a computer using CD-ROMs and the internet in the form of e-learning. e-Learning consists of content (information) relevant to the learning objectives. It uses instructional methods (techniques) such as examples that are practical, in order to help such learning. It also uses media elements such as words and pictures to deliver the content and methods. e-Learning builds new knowledge and skills linked to individual learning goals. In general, e-Learning courses include both content and instructional methods to help students learn the content. Learning courses are delivered via the computer using words in the form of spoken (narration) or printed text, and pictures such as illustrations, photos, graphic animations or videos. In short, the goal of e-Learning is to build knowledge and skills to help individuals achieve personal learning goals (Mayer, 2009).

4. Theoretical framework

The theoretical framework of this study is based on the incorporation of the elements of mastery learning with the elements of cooperative learning. This study seeks to explore the effectiveness of the result in the combination of these two strategies in the context of e-Learning via interactive multimedia learning courseware as shown in Figure 2.
5. Implementation Strategy

The implementation of ILMC using three different strategies as shown in Figure 3 will be done in three main phases. In the initial step, all students will sit for the pre-test in order to find out their prior knowledge with regard to a specific topic in Biology. Next, the students are divided into three groups. Each group will use a different learning strategy. In the third phase, after exploring the courseware in the computer laboratory over 3 sessions (with a duration of 2 hours each) during the tutorial sessions, students will sit for their post-test to evaluate their achievement.

![Figure 3. Research Design](image_url)

6. Conclusion

Most of the feedback given by the respondents supported the implementation of Interactive Multimedia Learning Courseware (IMLC) as part of their biology learning process. It is hoped our proposal of using IMLC in association with three different learning strategies will be a viable alternative approach to the current classroom situation for all Matriculation students as a means of achieving a significant increase in student achievement with regard to the learning of biology.

References


