Chapter 18
Design and Development of a Multimedia Constructivist Learning Environment to Affect the Achievement of Chemistry Learners

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ABSTRACT

The multimedia instruction design has undergone a paradigm shift, moving from objectivist based environment towards a constructivist based environment. This study examines the effects of the Multimedia Constructivists Instruction (MCI) and the Multimedia Objectivists Instruction (MOI) on 169 Form Four pupils’ achievement in the learning of “The Chemical Formulae and Equations”. The MCI is designed using the Jonassen’s Constructivists Learning Environment model whereas the MOI is designed using a linear based approach.

A quasi-experimental design was used in the study to measure pupils’ achievement (dependent variable) towards chemistry and multimedia instruction. The study employs a 2 x 2 factorial design with repeated measures. The moderator variables are students’ ability level and cognitive styles. The independent variables are the MCI and the MOI approach. Four research questions, four main hypotheses and nine sub-hypotheses were formulated and tested using the inferential statistics (ANOVA).

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The MCI pupils performed significantly better than the MOI pupils in the multimedia instruction. The high-ability pupils also performed significantly better than the low-ability pupils in the multimedia instruction. However, the field-independent pupils did not perform significantly better when compared to the field-dependent pupils in the multimedia instruction. Implications of this study in the context of constructivist learning were discussed.

INTRODUCTION

Malaysia, as a fast developing nation, is moving towards realising her vision to be a progressive and fully developed country by the year 2020. One of the challenges of Vision 2020 is “to establish a scientific and progressive society, a society that is innovative and forward-looking, one that is not only a consumer of technology but also a contributor to the scientific and technological civilisation of the future” (Jabatan Penerangan Malaysia, 1997). The emphasis in science and technology has introduced multimedia as one of the delivery systems into the schools.

This study intends to design and develop a constructivist-learning environment for the pupils to learn ‘the mole concept’. It also employs the multimedia instruction as a medium of instruction to investigate the pupils’ achievement in chemistry. As many researchers documented that ‘the mole concept’ is taught and learned using the problem-solving method, the multimedia instruction for the constructivist learning environment will be based on the problem solving approach. The researcher also examines whether ability level and the cognitive styles affect the pupils’ achievement towards chemistry.

Computers as the technology in the multimedia stream, have long been introduced in the Malaysian schools but the usage of computers in schools is restricted to produce only computer literate pupils. Many schools use computers for documentation purposes only but in this age of information technology, the usage of computers as an instructional medium in schools is more imperative due to the huge volume of information that is changing rapidly. Thus, most schools are equipped with computer laboratories but these computers must be fully used as an instructional medium.

In the year 2000, chemistry subject in Malaysia have undergone the reorganisation of the syllabus with the integration of the constructivist learning method. One of the objectives was to incorporate the constructivist approach to the learning and teaching of chemistry. There are various constructivist learning methods being introduced such as inquiry learning, mastery learning, problem-solving, discovery learning and so on. However, the teachers were not provided with the expertise training to implement these methods. The teachers are still lacking of constructivist materials and readily accessible models of instruction.

From the year 2003 onwards, the Ministry of Education supplied all schools in Malaysia with laptops to enable the teachers to integrate the usage of laptops in teaching and learning process to accommodate the revised curriculum of 2000. However, these laptops are used as a teaching aid only and the courseware was designed in an objectivist manner.

New theories and change of paradigm play an important role in improving and also overcoming the learning difficulties in chemistry. Since Form Four pupils are in the transitional position from concrete operations to formal operations according to Piaget’s (1970) perspective on the thought processes, it is vital for educators to design an instruction that will enable the pupils to learn chemistry in a formal setting. The instruction should also be designed in such a way that the Form Four pupils would be elevated to the formal operations level and impose hypothetical-deduc-
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