Exploring Students' Conceptual Change Through Abductive Inquiry: A Fun Science Experiment

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ABSTRACT: The decrease of students' interest in science subject has been quite concerning. However, the traditional direct instruction that is teachers oriented mainly focused on preparing the students to master the syllabus in pursuit of getting an A for Science in examination. Therefore, other teaching approach is required in order to help the students learn a meaningful learning. This study specifically examines how a mobile web science inquiry application can help the students getting meaningful learning by developing students conceptual understanding. This participatory qualitative research involves eight Year Three students that were selected through purposive sampling method. Radical constructivism and reflective awareness are used as background theory. The content of this application is based on varying degrees of students' cognitive level. Prototype methodology of system development life cycle was used in developing this science website. The research found that the website developed helps the students in improving their learning quality by enhancing their conceptual understanding.

Keywords: Web-Based Inquiry; Science Education; Participatory Design

1. INTRODUCTION

The use of mobile technology has been proven immensely for growing further the students' engagement in teaching and learning session. Not to mention the students' motivations and learning experience itself [1]. Computer or digital simulations used in Science teaching can be defined as a computer program that mimics the behavior of a real system [2]. They can be used to investigate scientific phenomenon as a part of inquiry-based teaching [2]

Mobile technologies are converting the conventional classroom setting with interactive classroom applications. With this revolution, subjects in school will be taught on virtual learning platforms through interactive lessons.

These interactive classroom applications have the probable to enhance the students' learning experience [3]. This is because of the schemes of these mobile technologies that offer a divergent level of engagement [4]. Thus, these mobile technologies may become a trustworthy choice of technology for providing learning experiences.

Inquiry-based education (IBL) is a form of active learning approach that is strongly student-centered that is driven by inquiry or research. Effective inquiry-based learning courses are making use of purposefully structured problems or scenarios that further can develop and enhance students' critical thinking skills, interpersonal skills and group collaboration skills [5].

Science activities that use authentic inquiry-based learning provide the students with the resources in assisting them to understand domain-specific knowledge by engaging in scientific reasoning processes; hypothesis generation, experimentation and evidence evaluation [2]. This seems to have twofold advantages; learners are able to develop understanding and knowledge about the scientific phenomena that they observe in the physical world, and they also identify how to perform the steps of scientific inquiry like scientists [7]. These two aspects are inter-related in that learners will not learn from inquiry without knowing how to do inquiry, and on the other hand, a particular domain is always required for practical inquiry skills [8].

Research on inquiry-based learning indicates that learners need support to overcome difficulties with a certain task, such as drawing a conclusion [9]. This scenario grants us the opportunity to explore a new way to use mobile learning application through science inquiry learning activities. With this in mind, we have developed a web-based learning application in order to explore science inquiry activities.

Through the use of this web-based inquiry module, students are assisted in interpreting data or hints into meaningful hypotheses. The learning process will further enhance the students' critical thinking skills and also help the students in coping the conceptual understanding of science lessons. In order to evaluate the mobile learning application's effectiveness on students achievements, the Triple E evaluation framework has been used [10]. The corresponding results and analyses are discussed later in this paper.

2. METHODOLOGY

This three phase participatory qualitative study used prototype methodology as a guideline in implementing the web-based Science inquiry module for the topic Plant. As shown in Figure 1, the initial requirement was conducted in phase one of the study; Concept Development. Design and prototyping, evaluation and review, and development were conducted in phase two of the study, Concept Mapping. While testing was conducted in phase three of the study;

Concept Confirmation.

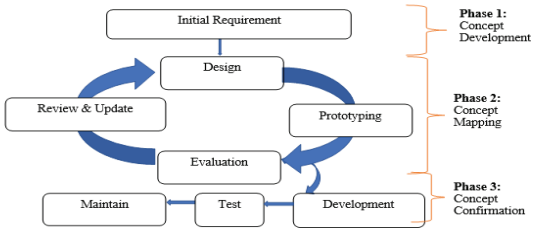

Figure 1 Prototype Methodology

Table 1 shows planning schedule according to the phases in the prototype methodology used. This analysis is structured according to the modified phases to ensure that the study can run smoothly.

Table 1 Planning schedule

COMPONENT	METHOD	DATA ANALYSE/INSTRUMENT	RESPONDENT	OUTPUT
PHASE 1: Initial Requirement	i. Semi-structured interview	i. QDA Miner Lite	i. 8 primary school science teachers	i. Criteria of inquiry ii. Content of the application
PHASE 2: Design and Prototyping	i. Document analysis	i. Checklist	i. Literature review ii. Existing Learning Application	i. Design documentation
PHASE 2: Evaluation and Review	i. Usability testing ii. Observation	i. Usability test document ii. Triple E framework iii. Content checklist	iv. Developer v. Literature review vi. Learning Theory and Model vii. 3 primary school science teacher viii. 3 information technology specialist ix. 5 students	i. prototype usability result ii. prototype quality and suitability result
PHASE 3: Development	i. Data analyses		i. Developer	ii. Web-based inquiry science application prototype
PHASE 3: Testing and Maintain	i. Clinical interview ii. Observation	i. Interview protocol	i. 8 students	ii. Validate the concept

3. RESULT AND DISCUSSION

Four conditions must be present to bring about conceptual change; student must be dissatisfied with the current understanding, student must have an available intelligible alternative, alternative provided must seem plausible and usable to the student. Three of the questions in the discussion were asked of the students for evaluating the application in term of their web-based learning experience, hypothesis generation process and comprehension about given topic. These questions were used to define the usability and the mobile quality aspects of the software quality measures. The students think that the application was easy to use and they did not find any difficulty while using it. Most of the students felt that the given hypotheses suggestions were relevant and make them think critically and being reflective. Almost all of the students were positive about their learning experiences. Most of the students enjoyed the innovative way of learning and found that the application was indeed interesting and engaging.

4. CONCLUSION

This study explores the use of a web-based learning application through inquiry method in improving students conceptual understanding among level one primary school students. Within four weeks, the study showed that the use of this module supports the development of critical thinking skills and problem solving. Despite constraints in the implementation of the module, the use of the web-based module and various activities designed to increase students motivation and interest in learning science and increase students conceptual understanding by using thinking skills in a more creative and effective way of solving a problem. Through the repetitive activities, students demonstrate more interest and motivation to learn, by applying creative thinking skills to solve the problem creatively.

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