Thai Students' Higher Order Thinking in Blended Learning about Circulatory system

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Abstract: Blended learning about circulatory system combines various activities in class and online learning for scientific inquiry and enhancing higher order thinking (HOT). The online learning provided simulations and interactive activities about circulatory. In order to develop students' HOT, this study will take six thinking hats technique of De Bono (1992) into biology inquiry. Participants included twenty six Grade 6 students of the primary school in a rural area of Khon Kaen which is located in the North East of Thailand. Higher order thinking representation was collected and interpreted from worksheets, assignments and open-ended questionnaire. Data analysis, the researcher investigated, analyzed, interpreted, and grouped the patterns of HOT answers. The finding revealed that the target group had frequency in expressing their HOT representations in "circulatory system". Majority of students held analytical thinking. These implications for instruction and the design of blended learning are discussed.

Keywords: Blended learning, higher order thinking, biology, primary school student

1. Introduction

It seems that Thai teachers had difficulties to build inquiry environment for science classroom. Not only teacher' knowledge and skills of providing scientific inquiry activities but also the limitation of time to cover the authorized curriculum through inquiry should be considered (Yuenyong, Tupsai, & Yuenyong, 2015). The advancement of internet technology gives teacher chance to build inquiry environment in science classroom. However, for Primary School Students, the web- based instruction was limited to them since children of this age, wanted freedom to learn as well as support (Kinawong, 1990). The web-based instruction probably carefully is managed for children.

The blended learning is a kind of knowledge management model including face-to-face, and online learning by combining equal part from each, into a unit of learning experience management (Thorne, 2003). The blended learning approach is considered on implementing an interactive, standards-based, and online curriculum. This will allow more time for meaningful scientific inquiry in the classroom setting as compared to traditional, face-to-face instruction (Singh and Reed, 2001).

2. Designing a blended learning environment.

2.1 Definition of blended learning

Blended learning was perceived and defined by educators in various ways. Clark (2006) summarized that blended learning was the norm for learners because learning will be constructed through variety of different situations. Blended learning instruction usually have been organized include both face to face and online teaching. Normally, 30 – 79% of the content is provided online (Allen, Seaman, & Garrett, 2007). The goal of blended learning is to combine the best features of in-class learning with the best features of online learning to deliver a valuable educational experience to students (Gilbert & Flores-Zambada, 2011). However, the combination of learning modalities goes beyond layering or repetition because true blended learning requires a

meaningful integration of the face-to-face and online learning experiences (Garrison & Kanuka, 2004).

2.2 Designing a blended learning for science classroom

Osguthorpe and Graham (2003) suggested six specific goals for designing a blended learning environment. These included: 1) pedagogy have to be redesigned to improve student learning, 2) providing variety of online resources, 3) Social interaction is vital during both face-to-face and online learning, 4) learning activities should allow students could be able to make choices related to their own learning, 5) cost effectiveness, and 6) ease revision should be considered.

Designing the blend-blended learning is not just about mix of technologies or media to access content but the design should be considered the nature of subject knowledge. The blended learning should consider rethinking and redesigning the teaching and learning relationship (Garrison & Kanuka, 2004). Aim of Science Teaching was not only for students to develop their knowledge and comprehension but also their higher-order thinking (HOT) included the analytical thinking, critical thinking, creative thinking, logical thinking, and scientific thinking (The Institute for the Promotion of Teaching Science and Technology; IPST, 2008). Therefore, the social interaction in both face-to-face and online learning should enhance students' higher order thinking in order to provide learning environment of scientific inquiry. Personal relevance also should be considered in science blended learning; therefore, the online science activities have to integrate with daily life issues. Scientific explanation and reasoning should be enhanced through interactive simulations, formative assessments, and discussion.

3. Methodology

Participants

Participants included twenty six Grade 6 students of the primary school in a rural area of Khon Kaen which is located in the North East of Thailand.

Circulatory System Blended Learning

Classroom instruction for circulatory system provided various activities in class and online learning for scientific inquiry and enhancing higher order thinking (HOT). Students required imagination and HOT in learning because the circulatory system is not visible. The online learning provided simulations and interactive activities about circulatory. In order to develop students' HOT, this study will take six thinking hats technique of De Bono (1992) into biology inquiry. The HOT representations of studied were mental representations of mental models based on Brewer's (1999) viewpoint by focusing on HOT of The IPST (2008) and blended learning of Driscoll (2002) combining between face-to-face learning and online learning in learning proportion 50:50 by organizing activities emphasized on enhancing complex thinking through six thinking hats technique of De Bono (1992).

Data Collection and Analysis

Students completed the open-ended questionnaire about HOT for circulatory system. The researcher also collected the worksheet, field note and participant observation to examine the HOT representation. Then, further interview probe students' HOT representation. Data analysis, the researcher investigated, analyzed, interpreted, and grouped the patterns of HOT answers. Then peers were interpreted one more times as peer debriefing. The valid is confirmed by member checking.

4. Results and Discussion

According to analysis and interpretation in responding the worksheets, assignments and open-ended questionnaires, found that the target group had frequency in expressing their HOT representations in "circulatory system", as shown in Table 1.

Table 1: The target group's frequency of HOT representations in " ***circulatory system*** " from worksheets, assignments and open-ended questionnaires.

HOT representations	Frequency from worksheets	Frequency from assignments	Frequency from open-ended questionnaires	Total
Analytical thinking	15	23	18	56
Critical thinking	6	10	8	24
Creative thinking	14	16	15	45
Logical thinking	4	11	6	21
Scientific thinking	13	2	15	30

From Table 1, shown that the target group had frequency of their HOT representations from worksheets on analytical thinking more than the creative thinking, scientific thinking, critical thinking and logical thinking, respectively. Frequency of target group HOT representations from assignments on analytical thinking more than the creative thinking, logical thinking, critical thinking, and scientific thinking respectively. Frequency of HOT representations from open-ended questionnaires on analytical thinking more than the creative thinking, scientific thinking, critical thinking, and logical thinking respectively.

According to the analysis and interpretation of findings in HOT representations titled "circulatory system", the target group had frequency of HOT representation on creative thinking in higher level than the analytical thinking, logical thinking, critical thinking, and scientific thinking respectively. It was supported by the findings of De Bono (1992), Pramlerk (2001), Komuitikanonth (2001), Saiwong (2001), and Chuenchitapirom (2007), that six thinking hats technique could improve students' thinking process which led to creative thinking, critical thinking, analytical thinking, systematic thinking and searching for guidelines of solution with reasons. Furthermore, the target group's HOT representations in "circulatory system" patterns, expressed by descriptive form, illustration with explanation, flow chart, diagram writing, table writing, chart writing and calculating technique. The highest level of frequency of HOT representations pattern was descriptive form because the students lacked of skill and experience in expressing their representations. It was supported by Wong-In's findings (1994) that those who were skillful in using the representations, would create the figure chart as concept and principle as well as be confident in representatives of media as connector with the problem whereas those who were not skillful would be confident in the problem sentence as wording language without using the meaning or other forms of information. Moreover, the founded behaviors of representations in thinking were: the using in symbol, picture drawing, table writing and diagram writing. In addition, it also found that students are interested and enthusiastic to learn as well, work completed as scheduled, creating a learning community network, and reflect on learning both directly and indirectly through social networking. It was supported by Gulsecen (1999) and Rovai and Jordan (2004), that blended learning could improve students'enthusiastic, motivation, attendance rate, interest in learning, and created learning community.

5. Conclusions

In utilizing research findings for the most benefit, the students should be provided opportunity in expressing their HOT representations regularly. Before using this study, the school context should be considered whether it is ready for instrument and media such as computer and internet. During online learning, the students should be taken care thoroughly by teachers so that every one of them would accomplish objectives of online learning. They should also were given an orientation in blended learning for knowing and comprehending together truly. They should be trained and stimulated for being responsible in attending online lesson regularly and get more opportunities to use high-order representations such as models, analogy, symbol, diagram, graph, chart, table and mind map in order to train their own reflection in thinking. The teachers might show their students various HOT representations regularly.

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