Review

Applying LEGO Mindstorms NXT in physical education and sport management

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The learning of strategies and skills by students, that is, students need to improve their problem-solving abilities by participating in games, a concept based on which TGfU (Teaching Games for Understanding) was developed. Nevertheless, it was found in this study that in the implementation of TGfU, students’ learning results and their motives were not satisfactory. The reason may be that, the school is located in Pingtung County in southern Taiwan, featuring tropical climate. When engaging in strategy discussion in ball games in May or June, students often appeared lackadaisical due to high temperatures. Very often, when an inquiry-based teaching method was adopted, some students demonstrated decreased learning motives because they failed to catch up with others and this could further affect the learning effect. Thus, the learning result will be influenced when students’ learning motivation and attitude are not very positive.

Key words: Experiential marketing strategy, flow theory, attitude toward physical education, physical education, LEGO Mindstorms NXT.

INTRODUCTION

Since the department of sport management, Aletheia University was built in 1995, the other colleges also followed in succession. More and more professionals devoted themselves to the area of sport management. It has accumulated numerous reports published on journal, bulletin and conference. Teachers often capture a knowledge concept detached from a situation and request students to memorize and recite it repeatedly. This way can only create temporary learning effects. When students are situated in a real scenario, they often need to re-learn the relevant knowledge; which means the knowledge learned in a detached scenario cannot be implanted in a real situation.

LEGO ROBOTICS

The digital technology just began to develop in 1984 and LEGO Group was partnered with MIT media laboratory; then they made a surprising achievement in 1998. Through the integration of LEGO bricks and the technology of robots, LEGO MINDSTORMS enable children to create a programming controllable LEGO model. In 2006, LEGO Group introduced a new generation of LEGO Robotics - LEGO MINDSTORMS NXT, which allows users to easily create a programming
controllable LEGO robot, and its complexity is even more than the last generation. The new generation robot can read, listen, feel and move (LEGO, 2007; Mitnik et al., 2008).

**The application in teaching**

It is well known that the designing concept of LEGO Robotics originated from constructivism and Seymour Papert’s constructionism. Papert stated that his word, constructionism, goes beyond the “learning by doing” philosophy of constructivism and should be thought of as “learning by making”. Constructionism stresses on the importance of tools and hands-on in learning. Children can solve the problem and challenges encountered in life through the use of tools and manipulating (Ajzen, 1991; Bollen and Stine, 1992; Breckler, 1984; Cheffers et al., 1976).

LEGO MINDSTORM is a tool that allows students to learn. The teacher gives a problem in a situation and students construct a way of learning through assembling blocks, designing programs to work completion. During the process, students face the problem, think for a solution, discuss with peers and share each others’ thoughts. Through trials, errors and several attempts, “children learn best by seeking out the specific knowledge they need to accomplish their goal.” (Csikszentmihalyi, 1975, 1977, 1982, 1990; Ghani and Deshpande, 1994; Goode et al., 2010), this is the process of active learning.

LEGO Robotics system is a new way for students to have hands-on experiences while learning Science, Technology, Engineering and Mathematics subjects (Jim, 2010). More and more literatures indicate that students’ engagement in robotic technology can facilitate students’ problem solving ability, creativity and team work ability (Peace et al., 2003; Hair et al., 1992, 1998).

Although, most teachers have the knowledge of operating computers, those who have actual experiences and skills of using LEGO Robotics in teaching are not many. Therefore, how to introduce the integration of LEGO Robotics to the common application of constructive learning in the elementary education is the question we encounter now (Barker and Ansorge, 2007; Benitti, 2011; Inghilleri, 1986; Mitnik et al., 2008; Myers, 1993; Lin, 2010; Rosenberg et al., 1960).

**PROGRAMMING**

To activate and control the robots, one must go through the program edited by computer, so LEGO Robotics becomes a popular means of teaching students to learn programming. The graphical interface of programming design of LEGO Robotics removes the difficulty of text interface, which can cause the students’ favorability to be more interested in learning programming design (Ryan, 1978). Dr. Eric Wang points out, the use of LEGOs is appealing to students (Toneatto and Binik, 1987; Webster et al., 1993; Smith, 1947; Bagozzi, 1982); meanwhile, it provides a great medium for teaching design, programming and creativity. The feature of Lego Robotics is the immediate response, which can help students to correct errors in no time and solve the problem through constant trials. At the end, students acquire satisfaction and sense of achievement in the process of displaying the robots.

The contest competition also provides additional motivations, which facilitate the development of new thoughts for better effects as well as facilitating students’ initiatives, creativity, self-learning and shared knowledge.

**PROBLEM SOLVING AND CREATIVITY**

Constructivism claims that learning is active and constant; through the hands-on process, learners add new knowledge to the existing knowledge and experience. Papert explains that the principle behind constructivism is that – learning does not mean to receive correct or wrong answer but to learn the work in daily life. Nor does it mean that any of the implementation methods is good. Usually, there are various ways of solving problems and some of them are more efficient in solving problems. The discussion of both advantages and weaknesses in a solution is valuable for gaining problem solving ability.

The study shows that Lego Robotics can be of a great tool of teaching students’ problem solving skills. Students can control the robot by their thoughts through designing and programming editing. When the robot does not perform some functions as students expected, it is a learning opportunity for correcting errors, self reflection of the failure, fixing programs and components so as to solve the problems by themselves (Mauch, 2001).

In the process of designing and assembling robots, teachers should encourage students to share thoughts for obtaining richer experience. Meanwhile, teachers should allow students to have more power of control instead of having them to repeatedly imitate others’ doing step by step. When students think and do actively, they are easier to create new thoughts (Schmitt, 1999, 2000; Skadberg and Kimmel, 2004).

**MATHEMATICS AND SCIENCE**

Designing and invention are the important mathematical and scientific ideas; however, students are lack of such experiences. LEGO Robotics system supports various designing activity in which students can learn important thoughts of Mathematics and Science (Michael et al., 2010).

Lego Robotics activities involve various concepts of Mathematics and Science. It is valuable if teachers
provide freedom to students for creating meaningful things to students themselves because students pay attention to and are interested in their work, which is lacking in most school activities (Schmitt, 1999, 2000; Skadberg and Kimmel, 2004). Thus, students can do their best on exploration and make connections through the activities of Mathematics and Science. This idea is at the core of Papert's theory of constructionism.

TEACHERS AS DESIGNERS

When students are lacking of familiar techniques to design, and program the robotic artifact, how do we integrate LEGO Robotics to teaching activities? How do teachers, as designers, provide hands-on opportunities for students in the robotics environment to explore by themselves?

Chen (2012) seem to provide a great method (Chen et al., 2012; Shih et al., 2012a-d). In their classrooms, they created a robotic caterpillar and have students to put the caterpillar in the environment designed by students themselves and further observe the transitional process of a caterpillar becoming a butterfly.

In another lesson, teachers created a robotic spinning wheel which is pasted with the pictures of the life cycles of insects, such as tadpoles. Through spinning the wheels, students can learn the concept that the changes of life cycle is non-stop. The older kids can learn to perform tasks and solve problems from building up animals or gardens of LEGO bricks, which they have been familiar with from their young age.

Although it is teachers’ responsibility to design robots, students can have exploratory learning activities through the learning environment created by the teachers. Chen (2012) provides a workable way for a classroom that is lacking technical activities, by adopting the constructive learning using tools with rich technology so as to enable students to link both concrete and abstract activities of exploration.

CONCLUSION

Based on the abovementioned theory, we combined experiential marketing strategy, flow theory and attitude toward physical education, as shown in Figure 1. Therefore, a questionnaire can be used to analyze users’
intention. Experiential marketing strategy is from experiential marketing strategy that has five dimensions: Sense, Feel, Think, Action and Relate. The Flow theory contains “Factors Contributing to Flow Experience”, “Flow Experience” and “Consequences of Flow Experience”. We quote the part of Flow theory, including Flow Experience and Increased Learning from “Consequences of Flow Experience”. In summary, we contribute to the development of attitude influenced by Experiential Marketing Strategy and Flow Experience.

The objectives of sport management and departments were prone to be diverse in order to correspond with sport industry environment, the needs of markets and students, including “to cultivate sport management personnel”, as well as “to cultivate leisure manage. It is necessary to understand a potential model to explore the relationship between experiential marketing, cognition of attitude, behavior intention, and effect of attitude, flow experience and increased learning.

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