

# Using constructivism as a basic idea to design multi-situated game-based learning platform and its application

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**Abstract**—Nowadays, e-learning becomes a popular learning strategies because of the advance in technology and the development of learning platforms. At present, most of platforms are designed for single topic rather than multiple topics and are difficultly extended to different topics, since learning mode, design, and limitations of applications for game-based learning. Therefore, in this study, we developed a tower defense game-based platform based on situated learning theory and constructivism of knowledge and this platform can be applied to diverse learning programs. In this platform, users can learn in a simulated scenario. Additionally, the flexible design of platforms will provide the usability and expandability of the system.

**Keywords**—Game-based learning; Situated learning; Constructivist Learning.

## I. INTRODUCTION

With the advance in technology, there is a tendency to apply digital multimedia information technology in teaching. Since the e-learning not only is interesting, interactive and real-time resulting in learners' motivation and interest, but also lacks of the limitation of time and space for learners. If teaching materials can combine with the information technology, learners can gain knowledge and skills through interactive learning more efficiently.

Recently, many educators and researchers promote the philosophy of education, "edutainment". They think that digital game-based learning, e-learning combining with game-based learning, will solve the learning problems of lack of fun and motivation through traditional learning situation, and can enhance students' motivation to learn and absorb professional knowledge and skills during the games. In literatures, many researchers proposed education theories to prove that digital game-based learning can carry out positive learning effect for learners [1][2][3][4]. Pidd (1992) indicated that using computer simulation to learn is more economical and safety, as learning

with expensive materials [5]. When playing the game, people can adjust their own learning pace to try to advancement and learn how to deal with individual needs and solve problems by themselves in virtual learning environment. In this situation, students will reduce stress on punishment for bad exam or wrong choices. Moreover, Garris, *et al.*(2002) proposed a model for illustrating the internal transformation process of learners using digital game-based learning (Figure 1).

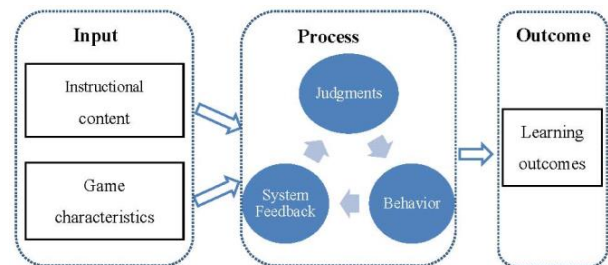


Figure 1. Model of game-based learning by [6].

Various researchers explained why the games attract learners to actively participate in learning processes. One is the extrinsic motivation, which describes that participants join in the processes in order to obtain some rewards. The other is the intrinsic motivation, which says that participants join in the processes due to curious, challenge, imagination, cooperation with others and respect. Additionally, Csikszentmihalyi (1975) proposed the flow theory to show that people can completely participate in some activity and feel joyful and satisfied when they are addicted to certain things [7]. Actually, in game-based learning, learners will love in learning due to the fun and the challenge.

However, since learning style, design, and limitations of applications for game-based learning, most of platforms are designed for specific single topic rather than multiple topics

and are difficultly extended to distinct topics. That is, when the learning topic is changed, the digital game-based learning platform needs to be re-designed for a new subject. This results in the design of the digital game-based learning platform lacks of flexibility in subjects.

In this research, we utilized inventory management knowledge from business situation, such that users can learn various topics and the difficulties and time of designing and developing the system will be reduced. That is, this platform dose not need to be re-developed, while only the database need to be modified to fit new interactive model of offense and defense. This will enhance the scalability and diversity purposes of the system. This platform not only instruct users to learn and to construct knowledge through simulated situations in the game, but also is flexible to extend learning subjects and applications.

## II. METHOD

In game-based learning, learners will learn knowledge and skills well due to the connections and relations between behaviors in the game and the situation in the real world. The situated learning theory describes that learning will happen in the same context in which it is applied and is a social process whereby knowledge is co-constructed.

Constructivism is based on the idea that human learn knowledge through each individual learner to explore, to discover and to actively construct. This process of learning is subjective learning. Actually, in the process of learning, constructivism is more natural and learner will internalize the information and knowledge based on personal characteristics, observations and interpretations, then apply it to solve problems. Von Glasersfeld (1989) proposed three principles of constructivism: learners (1) construct their own understanding, (2) do not simply mirror and (3) reflect what they read [8]. So, knowledge is constructed from an interaction between individual's experiences and his/her ideas [9][10][11]. Thus, constructivism also emphasizes situated learning due to learning knowledge through constructing and discovering surrounding context. Moschini (2006) said that the main audiences in interactive game-based learning system are the learners [12].

Hence, in this study, we developed a multi-situated game-based learning platform according to the digital game-based learning model proposed by [6], situated learning and flow theory. We also considered four design factors, interface, interactivity, storytelling and balance [13], and constructive learning theory to design the platform and to integrate diversity learning subjects. Additionally, this platform adopts tower defense games as the basis of the system. Tower defense games can be applied to various learning topics, if there are suitable materials and topics to design. For example, users can learn network attack and defense strategies in computer security, how the temperature raise and how to decrease it under greenhouse effect, and the prevention and control of communicable diseases.

## III. RESULT



Figure 2. Topic selection



Figure 3. Unity-based game: Tower defense games

## IV. CONCLUSIONS AND DISCUSSION

Based on situated learning theory and constructivism of knowledge, we developed a tower defense game-based platform which can be applied to various learning programs. Users can learn in a simulated scenario through this platform. Additionally, this platform is flexible resulting in providing the usability and expandability of the system.

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