# A FRAMEWORK OF SCENARIO-EPISTEMIC GAME FOR PROFFESIONAL SKILLS AND HIGHER ORDER THINKING SKILLS

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## 1.1 INTRODUCTION

In the era of globalisation, there is a competition for innovative work. The world is racing ahead to produce innovative and creative workers who have professional skills to solve the complex problems (Friedman, 2005). Dede (2007) also agreed that the world will be dominated by innovation and knowledge. Employers have higher expectation on their workers. They are required to reason, analyse, evaluate and communicate effectively (Siti Noridah, 2012). Wagner (2008) designated that these are the vital survival skills that must be possessed by every individual. This has driven the workers towards higher challenges as they need to equip themselves with 21st century skills to deal with 21st century tasks (Partnership for 21st Century Skills, 2008).

Apart from that, previous study reported that the graduated students who have inadequate knowledge and skills have caused the problems in industry (Yampinij and Chaijaroen, 2012). Office of Accreditation Standard and Educational Quality Assessment (2007) found that they are lacking of systematic skill, analytical skill and synthesis skill. They could not analyse and solve the real-

world problems effectively (Rajendran, 2001). Bennett and Robinson (2000) have listed the three skills that must possessed by the most valuable worker are basic academic skills, higher order thinking skills and certain personal qualities. Therefore, effective and valuable worker can be produced through nurturing students with Higher Order Thinking Skills (HOTs) in school.

Many scholar and academicians have shown a great importance to foster students via learning activities, such as Socratic questioning (Yang, Newby, and Bill, 2005), alternate assessment (Elder, 2004; Gronlund and Waugh, 2009), argumentation (Bailin and Siegel, 2003), project-based learning (Ramsden, 2003), technology rich classroom (Siti Noridah, 2012; Bae, 2006) and collaborative learning (Johnson et al., 2010; Dierick and Dochy, 2001). Fisher (2001) agreed that effective teaching and learning activities are able to nurture HOTs. The learning outcome should not just lean on knowledge acquisition but aid to develop HOTs.

One of the instructional technologies used in educational practices is educational game. Prensky (2001) claimed that many researchers predicted that game-based learning (GBL) will serve the education world as the rapid advancement of technology. Students learn the content of knowledge indirectly and achieve learning objective at the same time while playing the digital game (Garris, et al., 2002). This can bring the enjoyment and excitement in learning process. Educational games indicated that the integration instructional content with game together (Koenig, 2008). He also urged that the environment of instructional games is able to develop HOTs such as critical thinking skills. Many researchers have testified the advantages of using games in teaching and learning process (Dickey, 2005; Gee, 2004; Simpson, 2005; Squire, 2003).

In this paper, the literature of game-based learning will be briefly reviewed and a framework of game which focuses professional practices will be introduced.

## 1.2 LITERATURE REVIEW

### 1.2.1 Game-Based Learning

In the era of digital and information, digital game-based learning attaches greater value in education field and slowly become the new approach in learning (Aldrich, 2004; Squire & Steinkuehler, 2005, Yuh-Ming, et al., 2013). Cicchino (2013) suggested game-based learning (GBL) as an effective strategy to nurture students' HOTs and promote content learning. Game-based learning can be regarded as cognitive tools that arouse student's motivation and engagement in learning (Burguillo, 2010; Colby & Colby, 2008; Garris et al., 2002; Lee & Probert, 2010). It can be used to teach in some subjects, such as mathematics, science, history, and language learning (Zin, Jaafar, & Yue, 2009). Wenglinsky (1998) found that computer games will enhance students HOTs and conventional drill and practice will lead students to have lower order thinking skills.

There are many studies showing that the GBL increases the motivation and performance in learning process (Burguillo, 2010; Ebner & Holzinger, 2007; Papastergiou, 2009; Wang & Chen, 2010). This is because educational games provide interesting learning environment that allow students to acquire deeper and longer-lasting knowledge of the content (Cicchino, 2013; Sung and Hwang, 2012). Koenig (2008) indicated that the environment of instructional games is also able to develop HOTs such as critical thinking skills.

However, there are studies argued that the inadequacies of the GBL. Apostol, Zaharescu and Alexe (2013) also pointed out that the possibility of using game-like learning may devalue the subject to be learned. Cankaya and Kuzu (2010) indicated that children learn by playing and having fun. Yet, it is a challenge to keep balance between learning and gaming (Kickmeier-Rust and Albert, 2010). Students might focus on the enjoyment of the game. Barzilai and Blau (2014) found that one of the core challenges in

GBL is to assist students to relate between the knowledge learned in game and disciplinary content. Therefore, the learning tasks in the game can be designed ground on the learning objectives. Then the students will not drift away from content learning. This may flourish the learning process.

Furthermore, games alone could not significantly improve students' performance (Apostol, Zaharescu and Alexe, 2013). They explained that some of the students may encounter problems in solving the task due to the lack of knowledge and understanding. Their ability is not enough to cope with the complicated situation and thus make them feel frustrated or demotivated. Therefore, teachers' facilitation is vital to the GBL.

Nonetheless, it is very clear that challenges occurred hinder the adoption of the games in the classroom. Watson, et al. (2011) have listed out the issues faced by teachers who conducted game-like learning in school. They claimed that problem with technology, fixed class schedule and the concern of parents and administration about the effects of gaming. Thus, Extra instructional support and good implementation strategies will ensure the effectiveness of game learning (Watson, et al., 2011). Sung and Hwang (2012) also urged that the importance of providing the learning support or guidance in GBL.

All in all, GBL is able to promote learning engagement, induce students' cognitive growth and potentially foster students' HOTs. Thus, it is important to indicate and introduce a suitable game that focuses on professional practice and induces students' HOTs

### 1.2.2 Epistemic Game

There are many popular games which enhance students' cognitive development such as role-playing games, simulation game, real-time strategy games, adventure games, action games, puzzle games, and chess games (Zhi and Zhenhong , 2008). However, there is a demand of the mastery of complex thinking,

technical language and problem solving skills even in elementary schools (Gee, 2003; Johnson, 2005). Shaffer (2007) introduced a computer-supported games based on real world practices known as epistemic games.

The main objective of epistemic games is to stimulate experiences of professional practices and help students to cope with the real world situation effectively (Nash, Bagley and Shaffer, 2012). Shaffer and Gee (2005) claimed that the epistemic games provide an opportunity for students to construct knowledge, apply knowledge and share knowledge while dealing with the games. They also urged that the epistemic games can solve the coming crisis in education. This is because the epistemic game allows the students to engender the experiences of the professional practices.

One of the great promises of the epistemic game is that students could develop their epistemic frame in the context of professional action. This enables the mastery of knowledge and skills (Shaffer, 2006). Students are engaged in making knowledge, applying knowledge and sharing knowledge via playing the epistemic game (Shaffer and Gee, 2005). Shaffer (2007) proposed that the epistemic frame is formed by the combination of skills, knowledge, identity, value and epistemology (SKIVE). The SKIVE elements form the epistemic frame of community and have the base structure as below:

1. *Skills (S)*: the things that people within the community do.
2. *Knowledge (K)*: the understandings that people in the community share.
3. *Identity (I)*: the way that members of the community see themselves.
4. *Values (V)*: the beliefs that members of the community hold.
5. *Epistemology (E)*: the warrants that justify actions or claims as legitimate within the community.

(Shaffer, 2006)

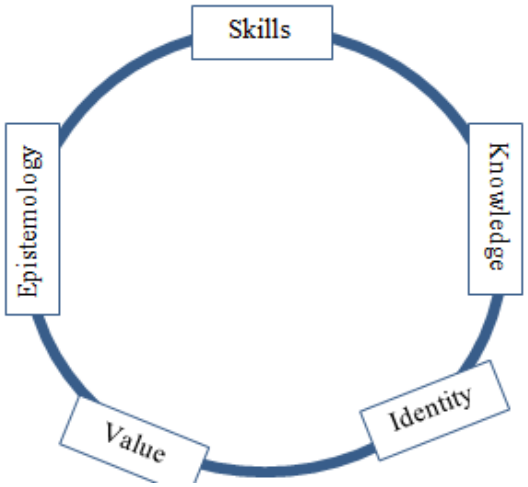


**Figure 1** The SKIVE elements are interrelated.

Figure 1 shows the combination of these frame elements characterise the professional ensemble and thus develop the professional way of thinking (Rupp, et al., 2010). They further accentuate the elements of the frame are interconnected and linked in practice. This helps students develop the professional patterns of acting and thinking that are driven by their epistemic frame. Thus, the epistemic game is able to engender students' knowledge and apply it in ways that HOTs. However, the learning support or guidance provided in game increase the learning potential. Therefore, it is vital to examine a suitable instructional strategy to enrich the epistemic game and yet helping the students in accomplishing the task.

### 1.2.3 Suitable Instructional Strategy used in Epistemic game

In order to maximise the learning experience through the epistemic game, a good learning strategy can immerged into the

game design. Scenario based learning (SBL), problem-based learning (PBL) and case-based learning (CBL) are the strategies that can be used to design the activities in games. Although Mery and Blakiston (2010) explained that SBL can be considered as PBL and CBL. However, they are different in between. Thus, the differences must be well notified and an appropriate strategy needs to be carefully chosen in order to select the best approach to create learning activities.

Table 1: The differences of scenario based learning, problem based learning and case based learning.

| Approach | Details |
|---|---|
| **Scenario based learning** | Students are put in a context and allowed them to explore the learning issues, and challenges. They are required to apply knowledge and practice skills relevant to the situation (Muhamad et al., 2012).<br>Students visualise and experience a practical scenario of what they learn in coursework (Siddiqui,et al., 2008) They have basic knowledge of the topics. |
| **Problem based learning (PBL)** | PBL allows students to apply their knowledge and skills in the new situation to solve the problem or to achieve definite goals (Williams and Beattie, 2008).<br>Students do not have basic knowledge of the topics. They must discover new methods by using the previous knowledge or principles (Williams and Beattie, 2008). |
| **Case based learning (CBL)** | CBL helps students to develop their perspective field via using case studies which are based upon real life problem in practice (Kaddoura, 2011).<br>CBL focuses on resolving a problem or case with well-organised teamwork (Rosenbaum, et al., 2005)<br>CBL engenders knowledge acquisition, skills and attitudes (Cender, et al., 2011) |

By referring to the table 1, SBL is selected as a strategy to

create a real world context in game-based learning. Students will be presented the epistemic game after they have gone through the topic in order to strengthen their understanding and thus enhance their HOTs. It has been widely used to teach the students in different professions such as engineering problem, corporate trainings and vocational educational program (Chu, 2007; Clark, 2009; Dahl, 2010; Naidu, et al., 2007). Siddiqui,et al. (2008) added that this approach of learning allows students to apply knowledge to the situation and practice the skills relevant to critical thinking and decision-making.

Kindley (2002) claimed that scenario based learning is effective when presents with game-like appearance. The epistemic games emulate real life situations and enable students to solve problems based on their real experiences. The decisions of the actions and strategies used in such learning context will enhance their learning experiences and increase the mastery of knowledge and skills. The integration of SBL into the game will be a good and promising tool to induce and foster students' knowledge and skills needed in the specific domain.

Clark (2009) introduced Ruth Clark's scenario-based model that simulates the real world situation as shown in Figure 1.

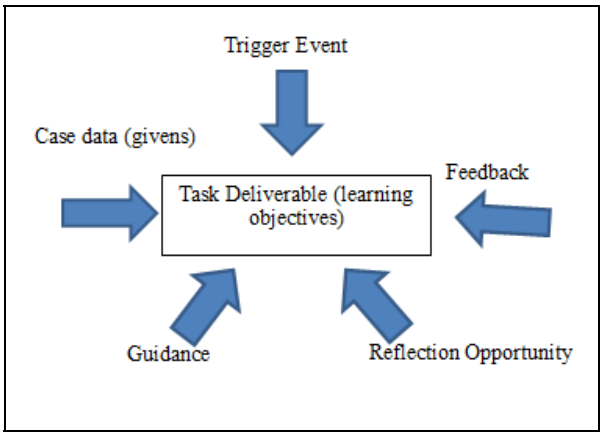


**Figure 2** Ruth Clark's Scenario-Based Model

Ruth Clark's Scenario-Based Model (Clark, 2009) explained that *Task Deliverable* as learning objectives must be set before designing the learning activity. Every scenario includes trigger event, case data, feedback, reflection and guidance that reflects the learning objectives. The learning tasks that grounded on learning objectives will prevent students to trivialize the subject learned. Apart from that, *Trigger Event* provides the script of the learning activity is launched based on specification for the scenario in the task deliverable. This can arouse students' interest and engage them in dealing with the epistemic game. *Case Data* provides players with all the details. Moreover, *Guidance* such as relevant models, tutorials and references is embedded in the game to guide the students who need assistance. This could improve students' learning capacity. *Feedback* is also a significant component to be considered as it expands students' learning experience with insights. *Case data, Guidance and Feedback* are the best learning supports while students encounter problem to solve the tasks. The students then can play the epistemic game at home independently without teacher's facilitation. Thus, this will not deter the fixed class schedule. Last but not least, students are given chances to think and reflect. *Reflection* allows them to recall and reflect what they learned throughout the game.

## 1.3 FRAMEWORK PROPOSED FOR SCENARIO-EPISTEMIC GAME

In the discussion above, the SKIVE elements to build students' epistemic frame and Ruth Clark's Scenario-Based Model will be used to create the scenario of the problem-solving situations. Shaffer (2007) believes that the epistemic frame is generated when there is a linkage between knowledge and practice (Shaffer, 2007). Dewey (1958) supports this by stating that knowing and doing is highly related. Each of the scenarios in the epistemic game is centered on learning objectives with the aim to

optimise the learning outcome by developing a better learning environment in the epistemic game. The students are trying to solve the problem and accomplish the goal by overcoming the obstacles in the task given. Therefore, the students are trained to think like an expert in their professional domain and solve problem in real world context created based on scenario-based learning. The integration of the SKIVE elements and Ruth Clark's Scenario-Based Model can thus generate the practice of HOTs in the epistemic game.

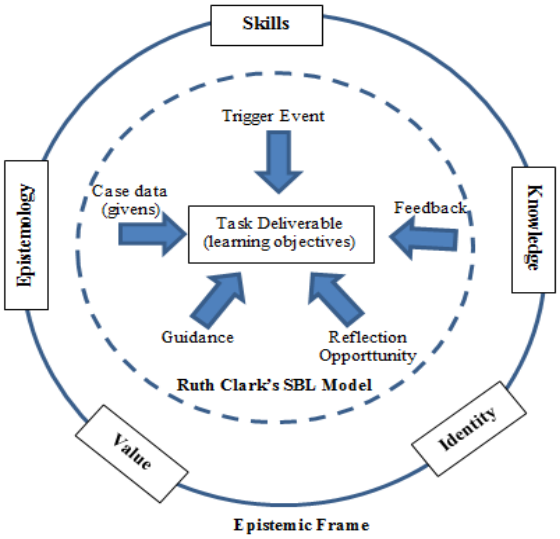


**Figure 3** Integration of Ruth Clark's Scenario-Based Model into SKIVE elements.

## 1.4 CONCLUSION

The scenario-epistemic game is authentic, real and reflective. Students are allowed to construct their own knowledge

and skills by critically solved the problems in the complex and meaningful ways. This could stimulate students' HOTs, develop a better content understanding and enhance their professional skills via game playing. The framework of the scenario-epistemic game focuses on professional practices and it is applicable to any professional domain such as chemist, lawyer and engineer. Thus, the education crisis can be solved and effective worker who meet the requirement in the 21st century will be hence produced.

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