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TOWARDS A CULTURALLY-ENHANCED SERIOUS GAME MODEL

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ABSTRACT

Current research shows that computer games were integral to the life of young learners across the globe. Hence, educators were looking at opportunities to use computer games in teaching and learning in order to address the needs of young learners. Meanwhile, learning needs and expectations were varied depending on the culture of a particular individual. Researches show that there were compelling connections between culture and learning, however studies in this area is still lacking. Thus, to address this limitation, four existing serious game models and frameworks were investigated. The outcome of this work is a serious game design model for culturally-enhanced serious game called GADEM. This model was extended from Four Dimensional Framework (FDF) and used pedagogical, Intercultural Communication and Social Construction of Technology (SCOT) as basis of extension. The target users of GADEM were both serious game designers and developers in order to guide them to design an effective serious game for learners

Keywords: *serious game, culturally-enhanced serious game, GADEM, serious game design model*

1. INTRODUCTION

Electronic games such as video games or computer games have become a new leisure activity not only for ardent gamers but also for other people. Increasingly, computer games have become a family hobby where people play together socially either online or in real spaces across the globe [1]. Entertainment Software Association (2014) reported that in 2014, approximately 59% of Americans played video games. Similar trend was also found among young Malaysians where 100% of first year and second year students had experience playing computer games [2]. Additionally, the same study revealed that young Malaysians had more than 5 years of game exposure in computer games activities regardless of the gender[2]. Considering how computer games have received considerable attention from people worldwide, the academic education research community nowadays has begun to pay significant attention to the ways in which computer games might support learning [2], [3] in order to meet the young learner's learning needs, preferences and expectations

Many researchers highlighted that learning needs, preferences and expectations were also attributed to the culture of a particular individual [4]–[8]. For example, Eastern learners were prone to teacher-centered learning style in contrast to Western learners who expected constructivist learning style in class, thus Eastern learners do not favored social constructivist e-learning tool [5], [9], [10]. Furthermore, in another example, evidences showed that Westerners preferences were inclined towards challenging and competitive activities as compared to Easterners [11], [12]. Moreover, other studies also revealed that instructional expectations among learners were also differ across different culture where people from Nordic countries (e.g. Sweden, Norway and Denmark) expected positive and encouraging feedbacks as compared to people from South Africa countries [5], [12], [13]. Therefore, considering cultural aspects in learning environment could match with learner's learning needs, preferences and expectations; thus improves learner's performance [4], [14], [15]. Practice showed that if culture aspects in the learning environment not aligned with culture of learners, this can result in conflicting behaviour that refrain the learners from reaching the objective of the learning [16].

There were few motivations that encourage us to highlight the game design model for culturally-

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enhanced serious game. First, culturally-enhanced serious game design is one of the fields that being ignored and still in critical need of intercultural investigation [5], [8]. Second, serious games were utilized as learning tools globally however game design model for designing culturally-enhanced serious game was still scarce [8], [15], [17], [18]. To address these motivations, this research paper aimed to (1) investigate and critically analyze existing game models and frameworks and (2) construct a serious game design model called GADEM which integrates culture components into serious game.

2. COMPUTER GAMES

In general, computer games could be described as series of events or actions that involve an individual or more (called players) in an artificial environment where players contend (even with one-self), follow certain rules, receive rewards or penalties (as the outcomes of their actions) in their quest to accomplish the pre-determined goals [19]. This artificial environment is supported by story, sense of challenge, game mechanics, conflicts, graphical representation and interactivity [19].

There were several categories of computer games such as mini, leisure and educational [20]. The distinctive characteristic between these categories was its purpose. The first category aimed to promote other computer game, while the second category aimed just to entertain players [20]. StreetPong was an example of mini game while Cut The Rope and Candy Crush were examples of leisure games. Meanwhile, the latter category aimed to convey educational contents to players rather than focused purely on entertainment [21]–[23]. In literatures, educational games were also referred as serious games [3], [24], [25]. Thus, in this research paper, the educational game was referred as serious game.

3. CULTURE

In general, culture is defined as aims, principles, views, characteristics and understanding towards significant events that are shared across the members of collectives and it is transferred from generations to generations [26]. Hofstede further added that culture is shared pattern of the mind that distinguishes the members of a group from another [27]. Therefore, culture could be described as a collective or a society will have similar and distinct behavior patterns, preferences, expectations and tendencies which distinguish them from other collective or society [8]. For example, Swedish preferred to have simple interface as compared to Koreans who more inclined to structured websites with many animations, colorful and hyperlinks [28].

Many researchers discovered that learning is also associate to culture [8], [29], [30]. Thus, considering the learner's cultural aspect could motivate learners and help them to make the connections between their culture and environment. However, as to date, research in this domain is still scarce particularly related to serious games [8], [29], [30]. Since the main purpose of serious game was to impart knowledge to players, authors believed that considering culture aspect in game design model is significant and important to improve the learning experience. This paper aims to propose a culturally-enhanced serious game model, thus the next section will critically review available game design models in the literature.

4. EXISTING SERIOUS GAME MODELS AND FRAMEWORKS

In order to construct a serious game design model for culturally-enhanced serious game; four mature serious game design models and frameworks were identified and critically analyzed. All these models were identified only from reputable journal articles and indexed conference papers. These serious game models were considered in this study due to its suitability to the research work in terms of similar target audience which is higher education learners. These four serious models and frameworks were Game Object Model v1 (GOMI), Game Object Model v2 (GOMII), Experiential Learning Model and finally the Four Dimensional Framework (FDF). The following subsections will explain each model and framework in detail

Game Object Model 1 (GOMI)

The first serious game design model identified in this research work was GOMI. This model was formulated by [31]. The fundamental basis of GOMI was to recognize the relationship between story, play and learning. GOMI was constructed heavily on the constructivism educational theory and was grounded on the Object Oriented Programming (OOP) paradigm. OOP concepts such as encapsulation, inheritance and polymorphism were used as metaphors in order to support the development and analyses of complicated designs and to facilitate the understanding of complex situations [32]. In this model, abstract interfaces and concrete interfaces concepts were used to

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distinguish between pedagogical constructs and serious game features. Fig 1 illustrates the GOMI.

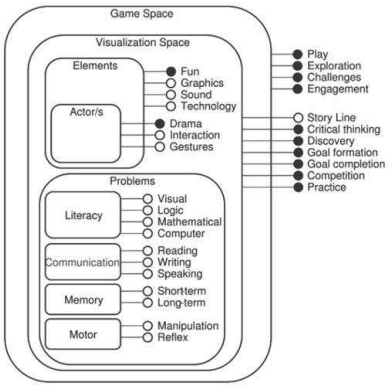


Figure-1. Game Object Model v1 (GOMI) [31]

Game Object Model II (GOMII)

The second serious game model identified in this research work was GOMII. GOMII was extended by the same author with different focus. GOMII focused on social interactions, challenges, narrative, and conversation in order to provide an effective serious game. GOMII could also be used as educational game evaluation framework. For example, game developers and game designers could use this model as a checklist to evaluate whether the abstract and concrete interfaces successfully support the pedagogy and achieve its educational objectives. Fig 2 depicts the GOMII

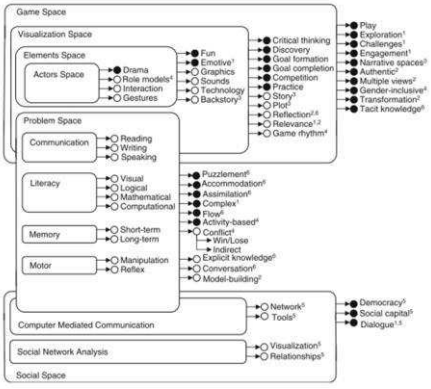
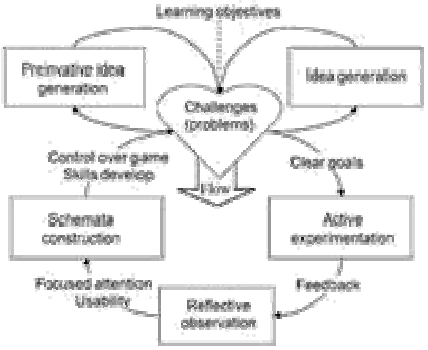


Figure-2. Game Object Model v2 (GOMII) [32]

Experiential Gaming Model (EGM)

The third serious game model was the Experiential Gaming Model (EGM) constructed by [33]. The model was constructed based on experiential learning theory, flow theory and game design. The aim of this model was to assist flow experience by connecting gameplay with experiential learning [33]. The model stressed on the significance of instant feedbacks, clear objectives and challenges that corresponded to the player's skill. The experiential gaming model comprises of three interrelated objects; a challenges-bank, an ideation loop and an experience loop. The author used human bold-vascular system as the metaphor to describe the model. These objects were hypothesized to facilitate and increase the learner's experience flow when in the serious game environment. Fig 3 shows the EGM.

Figure-3. Experiential Gaming Model (EGM) [33]



Four Dimensional Framework (FDF)

The fourth serious game model or framework is the Four Dimensional Framework (FDF) proposed by [34]. The primary aim of FDF was to guide the practitioners such as educators and tutors to choose appropriate serious game for formal learning. Four dimensions were proposed; learner specification, pedagogy, mode of representation and context. These dimensions were interrelated in order to support for more effective usage of serious game in formal learning environment. Although the initial aim of FDF was to guide practitioners in selecting appropriate serious game in classrooms, recent work shows that FDF also being used in the design and development of serious games and design of learning activities in virtual world [35], [36]. Fig 4 illustrates the FDF.

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Four-Dimensional Framework (FDF)	
Learner specification	Pedagogy
Context	Representation

Figure-4. Four Dimensional Framework (FDF) [34].

Those models and frameworks were analyzed based on its aim and focus, pedagogy, context, game genre, target audience, intended users, strength and its weaknesses. Table 1 depicts the summary matrix of each serious game model. From Table 1, it shows that all models or frameworks were based on sound learning theories such as experiential learning, constructivism, social constructivism, flow theory and principle of engagement since these models were intended for education domain. However each model or framework emphasized on different aspects, for example GOMI focused on the importance of story, play and learning in serious game design while GOMII focused more on storyline, challenges and social interaction. Meanwhile, Experiential Gaming Model emphasized on gameplay and flow experience as compared to FDF which focused on aspects that contribute in the selection of serious game in learning environment. Among all these models or frameworks, FDF is the only framework that include stakeholder into the framework.

Table 1 shows the summary of each serious game model and framework (i. e. GOMI, GOMII, EGM and FDF). These models and frameworks were analyzed based on the following criteria; aim, focus, pedagogy, context, game genre, target audience, intended users, strength and its limitations. These criteria were established based on authors' critical observation on characteristics of a good educational game or serious game found in the literatures.

In Table 1 GOMI was explained in the second column. The primary aim of GOMI was to integrate pedagogy and serious game elements into the design of a serious game. The integration of both elements in serious game design is justifiable since this game model is intended for designing educational games. In this model, constructivism learning theory was suggested to be embedded in the storyline and game-play. The intended user of GOMI is only limited to serious game designers. Furthermore, this model is suitable to design and construct adventure serious game for tertiary learners, therefore this model can only be used by researchers who want to encourage visualization and problem solving skills among the learners. Additionally, through critical analysis on GOMI, the model is too complex and superficial which makes it hard for the serious game designers to refer to.

Table 1 also explained on GOMII in the second column. As stated in Table 1, the primary aim of GOMII was to extend the GOMI by injecting social element into the model. Thus, this model is appropriate to be used when researchers want to design a collaborative serious game. GOMII was extended based on social constructivism learning theory and suitable to be applied for tertiary learners. The intended users of GOMII were serious game practitioners and designers. Additionally, GOMII may also being used as guideline to select suitable serious game for teaching and learning in classrooms. However, this model posed several limitations such as missing link on how to apply all those elements into practice.

Meanwhile, the third game design model – EGM- was described in the third column of Table 1. As compared to GOMI and GOMII, EGM adopted principles of engagement, experiential learning and flow theories in additional to constructivism learning theory into their model. Hence, this model focused on the gameplay and encouraging flow experience of the learners. EGM may be used by serious game designers for developing simulation serious game.

The last column in Table 1 described about FDF. FDF was initially constructed to assist education practitioners to choose an appropriate serious game to support learning in classrooms. However, evidences showed that FDF may also be used as a model to design a serious game. FDF relies on constructivism learning theory and suitable to be used in designing strategy, role-playing or adventure serious game. As compared to the other three game design models (i.e. GOMI, GOMII and EGM), FDF is the only model that considered learner aspects. Although FDF attempted to address learner aspects in its model, it ignored the importance of learner's cultural background.
From the analysis, it was found that there were very few models and frameworks that address the cultural aspects into the serious game design. Among all frameworks, FDF is the only framework that includes learner's aspects into consideration, however disregard on the importance of learner's cultural characteristics in the selection and design of serious game.

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5. THEORIES UNDERLYING THE DEVELOPMENT OF THE CULTURALLY-ENHANCED SERIOUS GAME DESIGN MODEL

This section will explore on the relevant theories which supported the development of the culturally-enhanced serious game design model. These theories include the pedagogical and theoretical constructs such as constructivism, experiential learning, Intercultural Communication and Social Construction of Technology theory. The following subsections described each theory in details

Constructivism

One of important learning theories that associated with serious game is constructivism [35], [38]. The theory describes how learning happens and highlighted that learners construct knowledge and meaning from their experiences [33], [35]. The key principle of constructivism is that knowledge is actively built-up by the learner through interaction with environment [35] and through reorganization of their mental structures [39].

One important concept in constructivism was "microworld" [19], [35]. [21] described microworlds as given domains or environments which may be explored in a non-linear way by users. The environment includes artifacts and objects, and learners may learn through exploring the environment and its objects in a relatively open-ended way [35]. Serious games that built upon constructivism learning theory utilized the "microworld" concept in order to immerse player in the serious game environment. Microworld enables players to freely explore the virtual world, for example interacting with other participants in the virtual world.

Experiential learning

Another important theory that associated with serious game is experiential learning theory [25], [40]. Experiential learning theory views learning as a process whereby knowledge is created through the transformation of experience [41]. It emphasized on the role of experience plays in the learning process [41]. Often experiential learning is meant to give the learner an opportunity to make decisions in a low-risk environment while at the same time giving the learner an emotional appreciation for how the concepts work in the "real world."

In serious games that build on experience learning theory, players plan strategy to win and assumed particular roles. For example, in VentureSim serious game, players assumed the role of a business manager. In this serious game, player needs to plan business strategies, run the business, involved in decision making process while making profit for the company. Thus in this serious game players think, talk and act similar to the „role" that they assumed. This is known as learning-by-doing where players learn something by doing it [25].

Intercultural Communication Theory

Intercultural communication theory has mainly been described in terms of national differences disturbing the sending and receiving of messages [42]. It essence, this theory seeks to understand how people from different countries and cultures act, communicate and perceive the world around them. One of the models associated with Intercultural Communication theory is Value Survey Module (VSM) introduced by [27]. VSM attempted to describe and differentiate a culture or a society based on five dimensions: Power-Distance (PD), Masculinity (MAS), Uncertainty-Avoidance (UA), Individualism/Collectivism and Long-Term Orientation (LTO). PD refers to the degree where less dominant individuals anticipate and admit asymmetrical power allocation within the culture [43]. Countries that have high PD view leaders as absolute superior and subordinates are assumed to act as they are told. Meanwhile, MAS refers to societies where social gender roles are clearly distinct. It refers to gender roles, not physical characteristics and is primarily characterized by the levels of assertiveness or tenderness in an individual [44]. UA refers to the degrees where individuals in the societies feel intimidate or fear by vague or unknown circumstances and attempt to eschew those circumstances. This feeling is expressed through nervous stress and a demand for predictability such as the need for written rules [44]. The contrast individualism/collectivism can be defined as "people looking after themselves and their immediate family only, versus people belonging to in-groups that look after them in exchange for loyalty" [44]. These cultural characteristics had uniquely identified the cultural identity of an individual and significantly affected their learning expectations and also inclinations towards a certain preferences and tendencies. For example, high PD society expected to receive strong support during their learning experience; when applied this practice into serious game design, feedbacks and hints need to be emphasized. In another example, high MAS society valued colourful and bright colors, hence when applied this practice in serious game design, appropriate background colors were used to address the needs of learners from the particular culture.

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Social Construction of Technology Theory

The Social Construction of Technology (SCOT) theory suggested that the meaning of a product is depends on how the product is adapted to meet the local needs [45]–[47]. The meaning of a product to a society was varied, depending on the culture of the society [12], [43]. The meaning of a product includes its usefulness and effectiveness. Thus, the perception of the usefulness and effectiveness of a product could vary to different culture.

To summarize, SCOT emphasized more on the usage and meaning of a product to a particular society. This theory shifts the interest of "creation" to "usage" and change of what a product signifies or intends for; to how the product is applied into the society. Therefore, the meaning of a product is not fixed by the design of the product but arises through the interaction between the product and its users. Hence, SCOT theory is important to provide the theoretical support of this research work in addition to the empirical evidences derived from intercultural communication theory

6. METHODOLOGY

The methodology of this work was basically analyzing the current literature related to "serious game", "culture" and "serious game models or frameworks". Prior to analyzing the literature, two selection criteria were set up. . First, this research work only considered research papers that have empirical results. Second, only research papers that appeared in peer-reviewed journal articles and conference proceedings were chosen in this work.

There were numerous serious game models or frameworks were found in the literature however, only few models were deemed relevant to this research work. These models or frameworks were selected based on its maturity as well as had supporting evidences on design and development of serious games. Furthermore, these serious game models were also selected based on its suitability to the research work such as similar target audience which is higher education learners.

7. RESULTS AND DISCUSSION

From the analysis of those four serious game models and frameworks, it was learnt that those models were lacking on consideration of cultural aspects; despite the undeniable associations between learning and culture. Furthermore, the analysis also revealed that FDF was the only framework that includes learner's aspects in the framework. These learner aspects include the learner's age, education level, demographics, conversancy with Information and Communication Technology (ICT) and games technologies as well as particular components of how they learn. Although FDF was successfully considered learner aspects as one of an important element to increase the efficacy of a serious game, however the framework was still missing on the cultural aspects in learners. Thus, this research work aims to address this limitation and include cultural component into the serious game model.

A serious game design model for culturally-enhanced serious game called GADEM was constructed in this research work. GADEM was extended from FDF. The aims of GADEM were twofold: to extend the original FDF by providing theoretical constructs for each dimension and also to realize these dimensions and its theoretical constructs into serious game elements. Fig 5 depicts the GADEM.

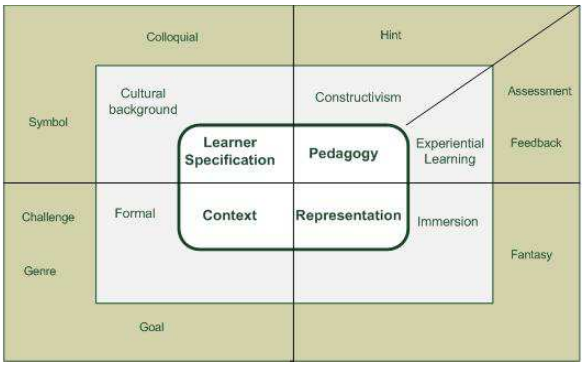

Figure-5. Serious game design model (GADEM)

GADEM regarded the design of culturally-enhanced serious game consists of dimensions, abstract interfaces and concrete interfaces. These dimensions were aspects that influenced the learning process in culturally-enhanced serious game and were represented in the clear rounded square in Fig 5. There were four dimensions; *Learner Specification, Pedagogy, Context* and *Representation*. These dimensions were interrelated and they supported each other to produce and support the player's experience when interacting and playing the culturally-enhanced serious game.

The inner layer consists of abstract interfaces which represent all pedagogical and theoretical constructs. The elements of abstract interfaces were *cultural background, constructivism, experiential learning, immersion*, and *formal*. The outer layer refers to the serious game design elements. *Symbols, Colloquial, Challenge, Genre, Hint, Feedback, Assessment,*

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Goal and *Fantasy* were examples of design elements. These elements were consistently mentioned in literatures as features that contribute to the effectiveness of a serious game [35], [49]–[55] as well as the association of these elements with culture [5], [30], [43], [56]. For example, learners from Power Distance (PD) society expected to receive support during their learning process, thus when manifest this practice into serious game requirement, *hint* and *feedback* elements were included in GADEM.

Learner Specification dimension focuses on profiling or modeling the learners. This dimension aims to ensure the culturally-enhanced serious game satisfies the needs of target audience and ensures a close match between the learning activities and the intended outcomes. Researchers found that learning needs were also associated with culture of an individual [13], [15]. Therefore, this research believes that considering the learner's culture background in culturally-enhanced serious game design was significant, thus the inclusion of *Cultural background* abstract interface in GADEM was justified. There were two concrete interfaces associated with *cultural background: symbol* and *colloquial*. *Symbol* refers to cultural concepts that were visible in practice such as pictures and cuisines [57]. Meanwhile, *colloquial* refers to informal Malaysian English [58].

The *Pedagogy dimension* focuses on the processes of learning. It includes a consideration of the types of learning and teaching models adopted for supporting learning processes. Pedagogy dimension consists of two teaching models: constructivism and experiential learning. These two teaching models were selected due to its effectiveness to support learning with technologies [25]. There were three concrete interfaces in this dimension: *hint, assessment* and *feedbacks*. These elements were selected based on its pedagogical contributions and its association with the culture of an individual.

The *Representation dimension* focuses on the representation of the serious game itself which includes the make-believe aspect in serious game environment such as immersion. The concrete interface in *Representation* dimension was *fantasy*.

The *Context dimension* emphasized on the particular environment where playing or learning was performed. The abstract interface for *Context dimension* is formal which refers to formal settings of learning environment. There are three concrete interfaces associated with *Context dimension* which were *challenge, goal* and *genre*. As mentioned earlier, these elements were selected due to its pedagogical contributions and its relationship with an individual culture.

8. CONCLUSION

As conclusion, GADEM is a model that was extended from Four-Dimensional Framework (FDF). In this research work, Social Construct of Technology (SCOT) and Intercultural Communication theories work as the lens through which authors considered in designing and developing serious game. This model stressed on learner cultural characteristics as one of important aspects in serious game design and development. Additionally, FDF insufficiently described learner cultural background in the framework even though researches highlighted that culture has compelling connection in influencing learning, preference and perception.

Furthermore, GADEM provides connection between educational theories, serious game design aspects and serious game development project. Even though several studies mentioned that FDF was used as framework in serious game development [35], however it was insufficiently described on how these dimensions were linked and translated into the design and development of serious game. Although it described on its usage in serious game design but it only focused in learner specification and neglected the other three dimensions. Moreover, GADEM extend the conceptual framework (FDF) into the area of application and provides a scope for serious game designers and developers to utilize specific elements for serious game design. Additionally, the pedagogical theories such as experiential learning and constructivism were conjoined into a meaningful object and linked to serious game design aspects.

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Table 1. Summary Of All Frameworks.

	Serious Game Models/Frameworks			
	GOMI	**GOMII**	**EGM**	**FDF**
Aim	Harmonizing pedagogy & serious game elements into serious game design	Harmonizing social element, pedagogy into serious game design	Connects gameplay with experiential learning to facilitate flow experience	As a guideline to evaluate serious games' suitability for classrooms & also as a serious game design model
Focus	Storyline, play & learning	Storyline, challenges & social interaction	Gameplay and flow experience	Aspects that contribute on the selection of serious game
Pedagogy	Constructivism	Social constructivism	Experiential Learning, Flow Theory, Constructivism, Principles of Engagement	Constructivism
Users	Serious game designers	Practitioners and serious game designers	Serious game designers	Practitioners and serious game designers
Context	Formal	Formal	Formal and Informal	Formal and Informal
Target audience	Tertiary	Tertiary	Tertiary	Tertiary & Adult learners
Game Genre	Adventure	Adventure	Simulation	Strategy, Role-play, Adventure
Example of serious games	Zadarh	yKhozi-The Burning Ground	RealGame, Day-Off, IT-Emperor	MediaStage, Savannah, CyberCrime Quest,Healthcare
Strengths	Suitable for designing narrative-based and puzzle-solving serious game	-Suitable for designing collaborative narrative-based and puzzle-solving serious game -suitable to be used as a guideline to choose appropriate serious game in classrooms	-Emphasize on facilitating flow experience of players which includes usability aspects, appropriate challenges and objects -Suitable for serious game that emphasize on problem-solving	- Include stakeholder into the model. -suitable for designing simulations or other forms of e-contents -suitable as guideline for practitioners & serious game developers -suitable for designing learning activities in immersive spaces -suitable for designing & developing strategy serious game which emphasize on decision making and problem solving
Limitations	-the model is too complex and superficial[33] - Difficult to translate the model into practice [37]	- missing link between the realization of educational objectives and the serious game elements -serious game developers found it difficult to utilize the model into practice	Works only as a link between pedagogy and serious game design which do not provide means for serious game development project	Lack of details on the utilization of the remaining dimensions such as representation, pedagogy and context in serious game development.

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