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Review Article

Game Factors and Game-Based Learning Design Model

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How to design useful digital game-based learning is a topic worthy of discussion. Past research focused on specific game genres design, but it is difficult to use when the target game genre differs from the default genres used in the research. This study presents macrodesign concepts that elucidates 11 crucial game-design factors, including game goals, game mechanism, game fantasy, game value, interaction, freedom, narrative, sensation, challenges, sociality, and mystery. We clearly define each factor and analyze the relationships among the 11 factors to construct a game-based learning design model. Two application examples are analyzed to verify the usability of the model and the performance of these factors. It can assist educational game designers in developing interesting games.

1. Introduction

Digital materials have recently provided considerable audio-visual stimulation to students, causing them to focus less attention on traditional lectures [1]. Learning motivation is closely related to outcomes [2]; thus, many people believe digital games to be essential future teaching tools [3]. Digital games develop high-level thinking skills such as problem-solving, strategic thinking, resource management, planning and execution, and adaption to changing work scenarios [4]. Therefore, developing useful digital learning games is worthy of examination. Mounting evidence has shown that educational games effectively achieve educational goals [5, 6].

However, Gunter et al. [7] indicated that certain learning games are unable to enhance learning motivation effectively because their learning content and game situations are incompatible. Although abundant resources have been invested in game-based learning (GBL) studies worldwide, how to design a game to promote effective learning remains unclear [8]. Game designers are able to create interesting games but do not know how to maintain the quality of teaching materials in a game, whereas educators focused on effective educational materials but do not know how to create interesting games [9]. Rather than being ineffective, the problem of educational games is that although they are more fun than traditional classroom activities, they are still considered boring. More and more computer-assisted instruction (CAI) systems added game elements into their system, and that causes the boundaries between boring educational games and CAI are unclear [10]. If a player does not feel that he was playing a game, then the educational game is boring and not interesting. Learning for players is an incidental consequence [11].

Presenting design details for various game genres is necessary, but macrodesign concepts must also be listed. Some researchers have attempted to design a framework for digital game designers, but such frameworks are difficult to use when the target game genre differs greatly from the default genres used in the research. For example, Choi et al. [12] developed a scale framework that is difficult to apply when designing a puzzle game because some items may not be applicable, such as making players feel like a hero and telling an engaging story. Numerous studies have focused on identifying crucial game factors and developing models, but factors have primarily been limited to a specific genre. How to employ game factors when developing an educational game is critical, and past studies have not solved this problem appropriately.

Game genres were created to generalize the current games, but the classification would change when a new

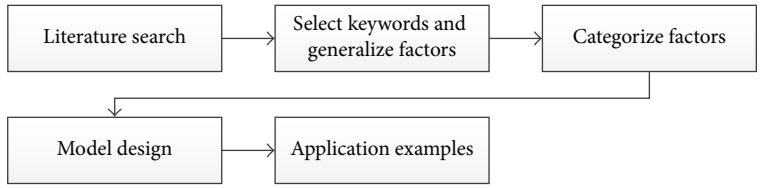

Figure 1: GBL model development.

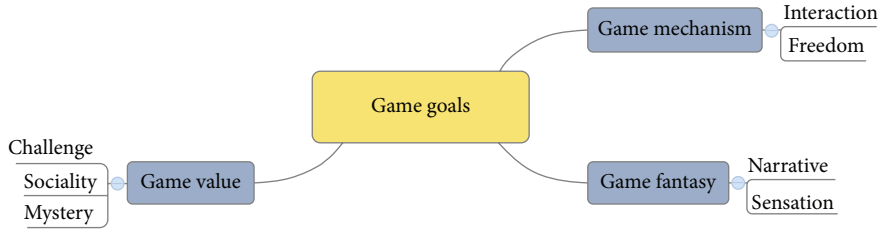

Figure 2: Factor categories.

groundbreaking game emerges. Game factors are a higher level design concept and should not be restricted by genre. In this paper, we present macrodesign concepts; starting from categorizing factors, the proposed model describes a thinking process to help people design and test educational games by combining game elements. Our results facilitate the development of more interesting educational games in the future.

2. Research Methods

Generation of the GBL model in this study involved five stages (Figure 1). The first stage included a literature search to clarify various viewpoints on game design. We searched electronic journals, search engines, and books for studies incorporating the perspectives of academic and commercial productions. Our literature selection included papers quoted and recognized in other studies whose primary concerns were game factors. In the second stage, we reorganized and redefined game-design factors which encompass most of the crucial factors mentioned in the literature. We categorized factors and drew a diagram to clarify the factor roles in game design in the third stage and structured those factors into a generic GBL design model in the fourth stage, which can help designers to employ the factors in their games. In the final stage, we analyzed two educational games based on the model to verify its applicability.

3. Literature Review

We elicited key factors from studies that we considered important for designing a digital GBL system and categorized them into three parts (Figure 2). Game goals are the core concept of game design, on which all factor designs should be based. The game mechanism enables smooth functioning of the virtual world and promotes player actions under the designer goals. Interaction and freedom are included in this part. Narrative and sensation are game fantasy factors composing the virtual world and can be perceived directly by players. We listed game value factors that make games fun, including challenge, sociality, and mystery. Brief descriptions of the factors are listed in Table 1.

These factors are dependent, and each affects the other. For example, the narrative occurs in a certain type of environment to depict fantasy sensations, and people must complete challenges to achieve certain goals. These factors cannot be entirely separated, and each factor is integrated with another factor to create a fun game.

3.1. Game Goals. The game goals are the core concept of game design, on which all factor designs should be based. Designer should consider what type of experience they want to provide for players, which could encompass a magical medieval world, various races that players could select, or cooperation or versus mode. A game satisfies gaming and engagement pleasure that would attract more people to join it.

Swartout and Lent [13] elaborated three levels of goals: short term, medium term, and long term. A short-term goal such as festival releases lasts only a short time and designer can hold various activities to understand player preferences in this chance. A medium-term goal typically has a lasting effect on the game world, such as launching new character classes, new levels, and new areas on the map. Long-term goals are the guidelines that designer must do their best to implement, which include maintaining professional balance and economic balance or developing an e-sport.

In most games, the system provides rewards when players reach a target specified by designer. These player achievements can include gaining power, gathering valuable game objects, or competing with others [14]. Bartle [15] indicated four types based on the objectives players pursue in digital games: killers, achievers, socializers, and explorers.

Table 1: Game factors.

Factors	Description	Sources
Game goals	Game designer provides what type of experience for players Players pursue game goals	[8, 14–17, 60–63]
Game mechanism	Refers to the methods prompting players to achieve the designer goals and enables smooth functioning of the virtual world	[16, 17, 60, 61]
Interaction	Player operations that trigger the computer to generate related responses, including the interactions and conflicts between players and computers	[8, 16, 18–21, 60, 62, 64]
Freedom	An open game system that allows for player autonomy, including individual services such as the avatar	[8, 61, 62]
Game Fantasy	Refers to environmental contexts that provide virtual world imagery	[28, 30, 61, 65]
Narrative	Describes what occurs in the virtual world	[16, 17, 30, 60]
Sensation	Multimedia presentation of the virtual world	[17, 19, 28, 30, 61]
Game value	Promotes players to increase their game motivation	[8, 16]
Challenges	Refers to player efforts toward the game or personal goals	[8, 16, 17, 19, 61, 62]
Sociality	The interaction between people through the game system including communication, cooperation, competition, and conflict	[15, 16, 19, 47, 62, 63]
Mystery	Refers to providing a novel experience for players, including curiosity and exploration	[15, 47, 61]

The achievers are specific goals that can guide players to explore game content and achieve player satisfaction.

3.2. Game Mechanism. The game mechanism is an important factor [16, 17] which includes methods used to achieve designer goals. For example, designers who want to achieve player cooperation can design a dungeon requiring the support of various character classes. The game mechanism must be implemented with careful consideration because it affects game balance. Certain game mechanisms can involve the amount of energy players deduct from an enemy during a fire attack, the frequency and quantity of the items players can use, and the types of activity players can engage in to obtain rewards. These mechanisms ensure smooth functioning of the virtual world.

3.3. Interaction. All interactions and conflicts occurring between the game program and the players are included in the interaction factor, such as user interface and controlling a character to attack foes, whose design has much influence on the players' satisfaction [18]. To design a friendly interface requires consideration of many design details. For example, hints are displayed on the screen, and characters can explore the map by the specified ways. It is available to assist and guide players to finish the game, and it is important for educational game [19]. This factor is a crucial game feature [20, 21] which may be completely different from game to game. For instance, the operation mode in a first-person shooter (FPS) game differs from that in a role-playing game (RPG), which is typically played from a third-person perspective. When a special operation mode is presented, such as lock-free battle mode, it can be used as a game highlight. Interaction determines the player's process and provides feedback.

3.4. Freedom. Games can be classified according to several genres, and the control mode, game processes, and game goals are different. Role-playing games focus on role control, whereas business simulation games, such as Sim City, focus on overall planning and control. Common individual services, such as the avatar, allow players to create, select, and change their virtual incarnation, thus increasing player immersion in the game [22] or increasing gamer loyalty [23]. Previous studies used control or individual services as the keyword, but they cannot apply to all games. Therefore, we suggest that game freedom refers to how many actions players can perform in the game system and how many individual services they can use. A sandbox game contains an open virtual world that players can roam freely, and tools are provided for players to modify the world themselves. There are a lot of freedom elements in the kind of game. In summary, freedom encompasses all of the game resources players can master. Wilson et al. [24] mentioned numerous studies indicating that control promotes skill-based outcomes and is a crucial aspect of educational games.

3.5. Game Fantasy. Game fantasy involves the game environment and background. Game designers construct the virtual world image through the game system, which includes stories and multimedia, and an entire worldview [25]. Crookall et al. [26] stated "A game does not intend to represent any real-world system; it is a 'real' system in its own right." All elements must be integrated into game fantasy to make it harmonious and to present a perfect narrative to players.

Educational games must make players feel immersed in the game [27]. The Threefold Model indicates that simulation involves internal harmony, and events must comply with the rules of the game world [28]. Narrative, sensation, and the activities of game players must be sensible; thus, teaching content must be integrated into game-world fantasy to render it unobtrusive. Numerous studies have mentioned the necessity of the fantasy factor; however, this does not imply unrealistic elements. The story background

can be real, such as the historical background in Age of Empires. Educational games should not put unmodified learning contents into a curious world that is obtrusive; an educator who adds teaching content to a game should make the materials abstract in keeping with the game background.

3.6. Narrative. Narrative describes what occurs in the virtual world and is undoubtedly a crucial factor to consider in game design. Narrative can appear by words but is more prominent in media. Using a game to tell a story poses a substantial designer challenge, similar to making an effective movie. However, the degree of importance of narrative in various game genres differs. Simulation and puzzle games typically include a game background, but adventure games and RPGs include a complete storyline. For educational games, narrative is a crucial factor in providing declarative knowledge for players. Kiili [29] indicated storytelling as a primary consideration before designing an educational game. Teaching content must match the narrative to create an effective educational game.

3.7. Sensation. Sensation presents the virtual world to players, including audio and aesthetics. The most common word used to refer to sensation is "simulation," a concept proposed in RPG theory [28, 30], which includes the game fantasy and sensation factors presented in this study. However, simulation does not apply to all game genres because puzzle games do not use simulation but require sensation. Thus, we selected sensation as a key factor.

In the age of advanced 3D imaging technology, audiovisual effects can make a game more attractive. Huang et al. [31] indicated that simulation, audio, and graphic elements are crucial factors for improving player motivation. To present invisible things through visual display contributes to the understanding of abstract concepts [32]. Therefore, abundant audiovisual media is available for educational games.

3.8. Game Value. Game value means that the game attracts players to initiate the game. Game value, derived from the book by Schell [17], The Art of Game Design, is a primary factor for players to generate motivation and immersion. All factors in this study prompt players to generate game value, but its source is not limited to these factors. Achievements and tasks are the goals and challenges of players, which lead to rewards. These processes enable players to obtain game value. Moreover, the game designer must consider the implied game value in each element and object. For example, money can be used to purchase attractive game items, prompting players to make money, and certain collected items have value to attract players. Designers should be aware of player preferences and arrange methods for them to achieve their goals. Goals that are meaningful for players generate game value.

Game value can also be discussed from the viewpoint of game consumption. Free-to-play games have recently appeared on the market, whereby game companies benefit through selling virtual game items. What motivates players to buy these items? Park and Lee [33] indicated that enjoyment value, character competency value, visual authority value, and monetary value exhibit a positive correlation with player purchase intention. These elements have proven their effectiveness for player value. In addition to promoting gaming desire, game value motivates players to spend real-world money to buy in-game items.

3.9. Challenge. To achieve goals, players must exert effort, and the effort is a challenge. Although challenge is not a necessary factor for a game, the process of reaching goals is typically accompanied by challenges [34]. Gee [35] indicated that games are typically challenging, often motivate players, and delight them or depress them when they achieve goals or fail. A challenge typically requires player abilities such as accuracy, muscular control, and quick thinking [36]. This factor is associated with game mechanism and game fantasy. Mechanisms such as tasks, rewards, and achievements promote challenge, which motivates players to achieve their goals. Solving a mystery typically involves a narrative, whereas sensation often appears in puzzle games.

Numerous scholars have indicated that challenge is a crucial factor of GBL [37, 38]. Wilson et al. [24] indicated that challenges exert a positive effect on the cognitive and affective outcomes of learners but require skill-level adjustment for players. For example, for a player who wants to explore a map in an RPG, the monster level of the map will affect the challenge level. This principle indicates that learning must be gradual.

3.10. Sociality. Social behavior within a game can be divided into communication, cooperation, competition, and conflict. This factor has received scant attention during the period before online (multiplayer) gaming. The rise of massively multiplayer online RPGs (MMORPGs) and social networks has rendered social behavior a crucial factor. Ravaja et al. [39] confirmed that player excitement levels differed according to when they were playing with friends, strangers, or nonplayer characters (NPC). Wu et al. [40] demonstrated that social interaction maintained player motivation and improved proactivity. Online games can cause the virtual relationship of players to assume a higher priority than reality [41], and rich social activities in a network can affect people's real life [42]. Wan and Chiou [43] indicated that social satisfaction is one reason why young people indulge in online games. In summary, social activities play a crucial role in online games.

The competition and conflict between players can also be regarded as social interaction. Mandryk et al. [44] indicated that players become more excited and engaged in a game when their opponent is another person rather than a computer. Regardless of whether social interaction in a game is cooperative or competitive, most players prefer to play with humans instead of the computer [45, 46]. For many people, sociality is one of the most crucial factors motivating them to continue playing a game [47].

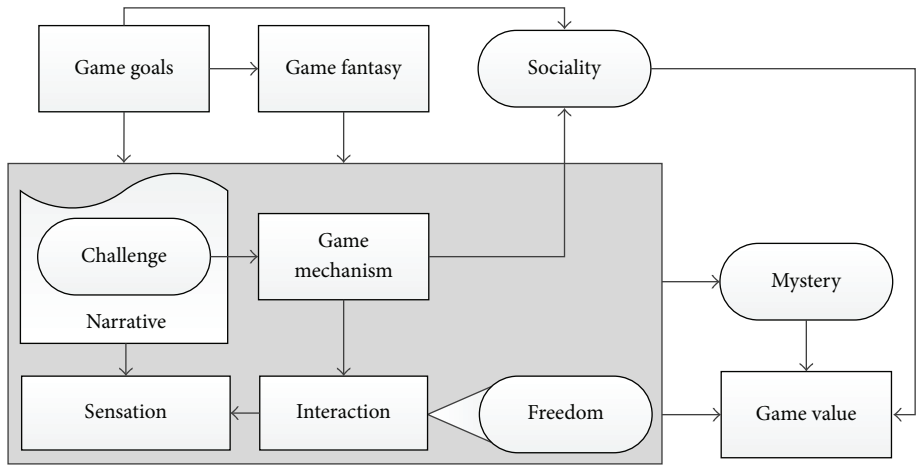

Figure 3: GBL design model.

3.11. Mystery. Garris and Ahlers [48] identified 12 gaming attributes, to increase the "game-like" feel in a simulation system. A key gaming feature is mystery, which involves player curiosity or exploration. Epistemic curiosity refers to the amount of novel experience provided to players [49] and has been proven to satisfy player desire [50, 51]. Billieux et al. [47] indicated epistemic curiosity and teamwork as the reasons why most people like to play the MMORPG World of Warcraft and showed the importance of the mystery factor in games.

Mystery is important but not a necessary factor and provides an additional bonus effect for games. If a game provides less novelty, players would be soon tired because it lacked the mystery factor. The mystery factor in business game is crucial for maintaining player curiosity about the game.

4. GBL Design Model

Games share factors, but teaching materials in distinct fields (e.g., history and physical education) differ widely. No standard exists for presenting teaching materials; thus, although GBL combines games and education, the model proposed in this study was only discussed for game factors. DiPietro et al. [52] deemed that game-design element is a crucial project. Creating materials is easy for educators, but combining them with a game is not. The model shown in Figure 3 represents a thinking process and can help educational game designers incorporate materials with their game.

The model starts with the game goals, and it includes teaching objectives and the experience they want to provide for players. In the educational game design proposed by Moreno-Ger et al. [53], identifying pedagogical requirements held the top priority. The teaching objectives must be considered first when designing an educational game, and learning achievements can be set in the game to promote players to exert effort. The user experience is closely related to the game fantasy factor because it defines the virtual world imagery and gives players a dream when they are gaming. Thus, game fantasy must be selected in the subsequent step. The teaching materials should be integrated into the game design rather than simply joining them [54]. Therefore, the materials are abstracted into the game and blended with game fantasy to form the game learning content. All implementations of the factors are based on game goals, and all elements must fit game fantasy.

In game system components, the challenge factor must be considered first, because it usually associates with the teaching objectives. Certain game challenges are generated from teaching objectives and learning content, and they test the player's knowledge and skill. Learning content contains a high degree of challenge [38]; therefore, although educational games should include challenges, we should notice that too large a challenge could make players feel a lack of accomplishment. The level of challenge must be adjusted according to the player's abilities to avoid a negative impact on the players [19]. In educational games, narrative is often used to encapsulate teaching content and challenge, and it would make them less strange in the game [29]. Narrative is suitable for transmitting knowledge, which can be combined with the storyline to facilitate player absorption. Sensation is built based on narrative of course, and it provides visual displays, such as images and 3D graphics, to show the virtual world. Because challenge is a leading factor in educational games, it should be the foundation of game mechanism design. The logical concepts of learning content can typically be merged with game mechanism, such as the standard operating procedure (SOP) that guides the players in sequent action. The game mechanism determines the interactions between the player and the computer, and the interactive interface influences game sensation. The learning feedback in educational games is a type of interaction, which is crucial in guiding students to learn. Freedom extends answer choices to increase the degree of learning difficulty and challenge, and it provides a game abundance. For example, people learning parabola can throw a ball from Point A to Point B, but this is boring. Game stages possessing a wealth of variation, such as those in Angry Birds, are more fun. However, regardless of game-stage expansion, it must remain consistent with game fantasy.

Sociality is a unique factor, and its implementation is determined by game goals. It can involve a simple interface for communication or for players to battle with others, and its design is based on the game mechanism. Sociality is an indispensable factor of cooperative learning and must be carefully planned to design a game to elicit player cooperation. Mystery can be implemented in any aspect of the game. It inspires players to want to know more about the game, such as what will happen next in the story and whether there is more beautiful scenery in unexplored areas and more challenge and variety in later levels. All factors could assist players to generate their own game values, and if an educational game could provide attracting game values, people will enjoy playing and learning simultaneously.

If we observe this model from the view of teaching, the first thing is to decide the teaching objectives, which is the game goal. Then, the game fantasy motivates students to participate in this game. The learning activities are the major challenges in the game, the sensation is the presentation of teaching material, and the game mechanism influences the learning process. Because the teacher is not around when the students are playing game, the interaction in a game guides them to finish this activity. The teacher should also consider that whether they require collaboration or cooperation in this activity. Finally, the freedom, mystery, and game value are the special factors only existent in games, and they are the main reasons why students enjoy this game.

5. Application Examples

5.1. Slice It! Slice it! is an educational game for Android and iOS systems in which players must slice geometric shapes into equally sized pieces. As indicated by the design model shown in Figure 5, the game goal was to promote player understanding of geometry, and a puzzle game was used to accomplish this. The designers aimed to provide a lively feeling, and a colored pencil style was selected to create the game fantasy. There are various degrees of challenge at the stages of game, based on the shape, the number of target shapes, and number of slices. As shown on the left of Figure 4, initially, the shape is in two pieces, and the target is to divide the shape into four pieces. The player must slice it to achieve the target in only one slice. Because it is a puzzle game, the lack of a narrative is acceptable. The game mechanism is easy to understand; the game would give a rank when the target number of pieces is achieved or the slices number emptied. The proportion of pieces sliced is shown at the end of a round (Figure 4, right). The game allows for numerous interactions, such as the method of slicing and buttons to show tips and undo moves, and other functions. To present a unified style, all components and animations are drawn on paper, using colored pencils, which constitutes the sensation factor.

The game comprises more than 300 stages. In addition to a variety of shapes, there are obstructions and auxiliary tools in the later stages, for example, red areas of the shapes through which slices cannot pass and blue areas that reflect slices, as shown on the left of Figure 4. This constitutes the

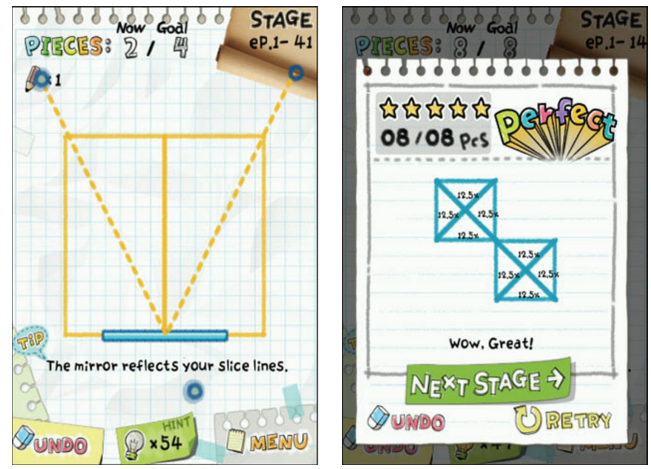

Figure 4: *Slice it!*

game freedom factor and it expands on the original gameplay. Because it is a single-player game, the sociality factor was not incorporated. All of game factors this game used provide game value for players to encourage them to complete the tasks.

5.2. Xiao-Mao. Xiao-Mao is a 3D role-playing history game (Figure 6) that was developed by Jheng et al. [55]. The game goal was to allow the player to experience and understand history, geography, and culture, such as the Songjiang Troupe, Martial Arts Parade, and temple celebrations. To make players explore nineteenth-century Southern Taiwan, a 3D simulated world was developed, thereby constituting the game fantasy factor [56]. This game uses the wuxia novel *Pussy* [57] as the narrative, and the role-playing game mechanism (RPG) was selected to convey the story. Players play the role of the heroic character *Xiao-Mao* to complete the tasks assigned according to historical events, which constitutes the challenge factor. To increase immersion, the character uses kung fu to defeat enemies, which constitutes the interaction factor. The game sensation emphasizes historical accuracy; therefore, the virtual environment, such as clothing and buildings, was designed according to reality or descriptions in historical materials. Players can roam the virtual world freely, which constitutes the freedom factor. The design model for *Xiao-Mao* is shown in Figure 7. The story and kung fu system were features in this game and offer mystery, and the game values encourage players to learn and to finish the game. Jheng [58] found 25 people played this game, and they are all over 21 years old. It takes about 2 hours to complete this game, and the learning effectiveness was verified in his research.

6. Questionnaire

We designed a questionnaire to survey players regarding two aforementioned games to elucidate their performance regarding the 11 factors. The volunteers wrote the questionnaire after gaming and got no reward. The questionnaire contained 35 items and consisted of 12 aspects including the 11 factors and

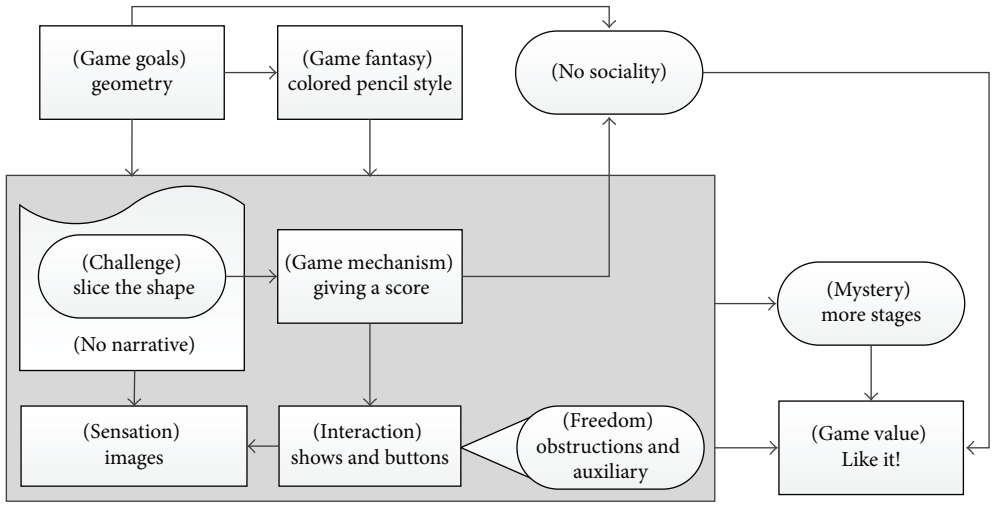

Figure 5: GBL design model for *Slice it!*

Figure 6: *Xiao-Mao*.

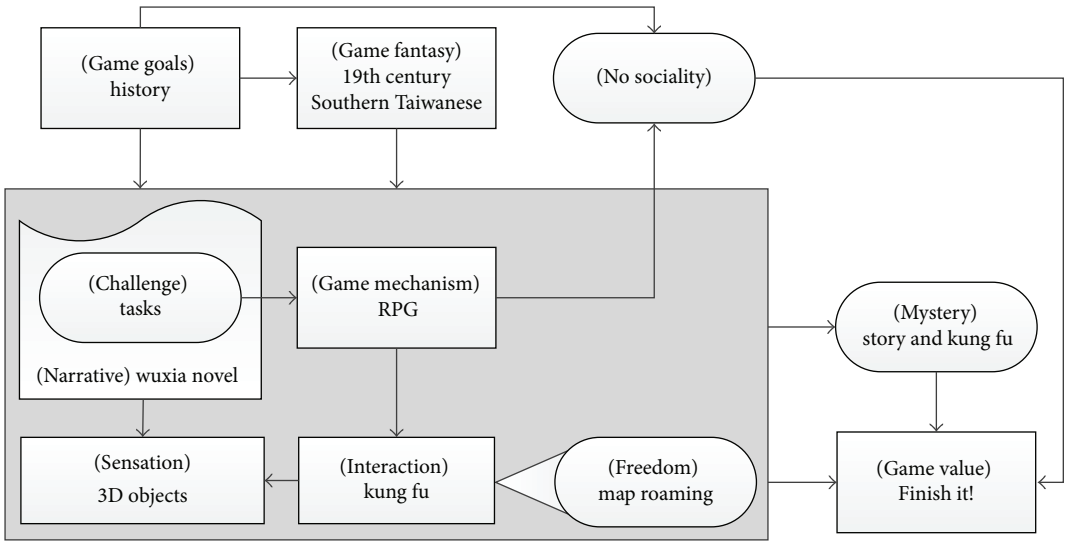

Figure 7: GBL design model for *Xiao-Mao*.

"flow" to determine the immersion level of players. The flow theory was proposed by Csíkszentmihályi [59], who indicated that a person ignores the reality of his or her surroundings when he or she is preoccupied. This aspect reflects the game attraction for players. The questionnaire used a 5-point Likert scale where 5 indicated strongly agree and 1 indicated strongly disagree. The survey results are shown in Table 2.

The questionnaire was used to analyze the factor design for the two games. The mean scores were as follows: above 4 indicated strong performance, 3 to 4 indicated room for

Table 2: Game factor questionnaire.

Items	*Slice it!* M ($N = 16$)	*Xiao-Mao* M ($N = 15$)
Game goals		
(1) The tasks or stages have clear goals.	4.50	4.33
(2) I know what I seek in this game.	4.44	4.00
(3) I'd like to complete the game's goals and achievements.	4.38	4.13
Game mechanism		
(4) The game's genre and gameplay are clear.	4.38	3.80
(5) The game goals and rules are clear.	4.25	4.27
(6) I like the gameplay in this game.	4.00	3.60
Interaction		
(7) The operational processes are easy and intuitional.	4.25	3.87
(8) The system tips are clear and real time and let me know what the next step is.	3.69	3.87
(9) The interaction with the device is fun.	3.75	3.80
Freedom		
(10) I can control my status and data in this game.	3.50	3.73
(11) I can play the game in various ways.	4.25	3.27
(12) I can create my own gaming history.	4.19	3.53
Game fantasy		
(13) The art style is unified, and the overall appearance is consistent.	4.25	4.13
(14) The characters and scenes in this game fit its environment.	3.56	4.20
(15) The game story and mechanics do not match.	2.25	2.07
Narrative		
(16) The game has a deep story.	2.19	4.27
(17) The plot is logical.	2.63	4.20
(18) I'd like to follow the story's development.	2.75	4.20
Sensation		
(19) The colors and layout of the interface attracts my attention.	3.69	3.80
(20) The icons and functions are clear and intuitional.	4.00	3.80
(21) The graphics and sounds in this game are abundant	3.31	4.00
Game value		
(22) I'd like to get more resources in this game.	3.13	3.80
(23) The game content is plentiful and interesting.	3.56	3.87
Challenges		
(24) The game is challenging.	4.44	3.80
(25) I can complete the tasks and finish stages.	4.38	4.33
(26) I'd like to get better gaming achievements than my now.	4.63	4.07
Sociality		
(27) I can communicate with others easily in this game.	2.19	2.60
(28) The game allows me to cooperate or compete with others.	2.44	2.67
(29) I like to cooperate or compete with others in this game.	2.13	2.73
Mystery		
(30) The game has some surprises.	2.63	3.27
(31) Before I finish this game, I'd like to know more about the follow-game content.	3.06	4.13
Flow		
(32) I was very focused on this game.	3.75	4.13
(33) I did not feel tired when playing this game.	3.13	3.40
(34) I often forgot the time when playing this game.	3.44	3.73
(35) I paid less attention to my surroundings when playing this game.	3.38	3.80

improvement, and below 3 indicated insufficient performance. A high score was not required if the factor was not considered in the design goals; for example, neither game incorporated the sociality factor; therefore, the scores were less than 3. If the game genres and design goals differ, the weights of factors also differ. The design weight of narrative in *Xiao-Mao* (an RPG) was clearly higher than that of *Slice it!* (a puzzle game). The 11 game factors can increase the attractiveness for players, but not every factor is necessary. All designs must be based on the game goals.

The questionnaire results can verify the game design. For instance, *Xiao-Mao* emphasizes a 3D simulation that is consistent with history; therefore, it received a score of 4.20 on Item 14 and Item 21 received a score of 4.00. Narrative was a design focus of *Xiao-Mao*, and all items for this factor received a score of at least 4.20. For *Slice it!*, the varied geometry and stages are its primary features, so Item 11 received a score of 4.25. It verifies this puzzle game has a wealth of fun and challenge that Item 24 received a score of 4.44, and Item 26 received a score of 4.63. Items 1 to 31 were related to game value, which is critical for players; therefore, it affected the scores for Items 32 to 35. The two games exhibited strong performance regarding flow, particularly for *Xiao-Mao*.

7. Conclusion

This study elucidates 11 crucial game-design factors to assist designers in designing, analyzing, and evaluating games regarding game goals, game mechanism, game fantasy, game value, interaction, freedom, narrative, sensation, challenges, sociality, and mystery. We avoided selecting excessively abstract factors that are difficult for designers to implement, such as "gamism" [30]. Each component in a game can be checked based on these factors. For instance, the purpose of a healing potion might be providing a method for players to restore their health and recycling game currency. We can get further reflection including the obtaining mechanism, the using way (interaction), the special efficacy (sensation), and the value for players such as properties, supplements, or garbage. These factors are macrodesign concepts for games and are not limited by genre.

We proposed the GBL design model to assist in designing educational games. This thinking process can reduce the design negligence and clarify the causality of each factor as the model shows. An RPG educational game should not be designed before the teaching content, which would represent research with methods but without a purpose. Game factors differ in designs and weights depending on the game goals and genre. For example, design should focus on interaction in action games. Finally, we analyzed two games in distinct genres based on the GBL design model and developed a questionnaire to assess the performances for each factor. This model can assist educational game designers in understanding how to use the factors and making their game more interesting.

This paper focuses on making educational game design more fun rather than enhancing the learning performance of students. We believe that if we can promote the motivation of students, they would have advanced learning outcomes naturally [2]. How to assess learning performances is important for an educational game, but it is beyond the scope of this paper. The easiest way is to use the traditional test to verify the teaching effectiveness of a game. If the learning outcomes of students would be evaluated by a game, to design the algorithm is critical, and it is a subject worthy of study in the future.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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