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Categorizing Game Design Elements into Educational Game Design Fundamentals

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Abstract

Educational games have become a highly prominent tool in schools to deliver an exciting learning experience. Large amount of literature discusses the importance of how educational games are designed has been highlighted that delivering learning through educational games design and how the game designers require crucial skills to design. Educational game design requires elements which are considered during the designing process. Looking at the projection of “Game designing or the process of game design is a complex task, and it is still being investigated”. Therefore, this chapter intends to discuss recent and prominent proposed game design elements that demonstrate their important characteristics in designing educational games. Consequently, two highly significant game design theorists with established fundamental elements of games are discussed. With critically understanding the elements, this chapter provides categorizing various existing game elements into established fundamental elements. Henceforth, it demonstrates a clearer overview of how game design elements can be categorized and applied. Future recommendations are also discussed.

Keywords: educational games, game design, design elements, key elements, game-based learning, fundamental

1. Introduction

Over the past decade, educational games (EG) and game-based learning (BGL) have become more common as a tool for learning and educational deliverance, as opposed to pure entertainment, which has gained immense popularity. Digital games are developed to be consumed through smartphones, computers, tablets, etc., whereas nondigital games explore the use of resources such as boards, card, pencils, and papers [1–4]. Game-based learning (GBL) is a pedagogical approach that utilizes EGs to support learning [5]. GBL utilizes an appropriate set of game mechanics (the rules of EG), provides freedom for learners to recreate scenarios without having a fear of adverse reactions, and provides a problem-oriented learning process to allow learners achieve learning goals in the EG [6].

Although the research has managed to accomplish a large range of EGs that has delivered its function successfully, there have been many EGs that have reported to be a failure or unsuccessful. It is definite that game designers do not create replicas

of the games that are well-recognized. Therefore, recent articles have addressed the rise in tension between stakeholders (game designers, teachers, developers, learners, students, players) involved in designing an EG and what causes the failure. Designers are required to enhance the educational tools by integrating game elements and core concepts to maximize the tools' effectiveness, to increase the possibilities of achieving learning outcomes, levels of engagement, and motivation [7, 8]. In addition to that, designing EG requires multiple consideration of multiple stakeholders such as game designers, developers, educators, teachers, and software engineers.

Game-based learning (GBL) has been defined by identifying its principles and mechanisms [9]. The principles target intrinsic motivation, learning through “fun”, authenticity (i.e. contextualized learning), self-reliance/autonomy, and experiential learning. Mechanisms include rules, clear but challenging goals, fantasy, progressive levels of difficulty, interactivity, player control, uncertainty, feedback, and a social element. This study focuses on the definition of GBL defined by Perrotta [9] as it involves game mechanics that are related to game design aspects. This may be due to a little consensus between researchers and among teachers as to how games could be used for educational purposes. GBL is specifically designed to teach specific concepts or to strengthen competencies. There exists a broad scope of games including digital and non-digital ones [1, 10–12].

Understanding the game design is a complex job. As defined, “Design is a process by which a designer creates a context to be encountered by a participant, and from which meaning emerges” [13]. Game design (GD) is defined as a variety of game design elements and learning theories that establish and define an EG. For example, design elements include goals, the game mechanism (rules), interaction, freedom, the narrative, challenges, motivational attributes, and also interactive problem-solving. Similarly, GD is equipped with learning characteristic that adds the value of providing a good learning experience to the learners. Some of the characteristics are learning outcomes, usability, user's experience, motivation, engagement, game design, user satisfaction, usefulness, understandability, performance, playability, pedagogical aspects, efficacy, social impact, cognitive behaviour, enjoyment, acceptance, and user interface [14–17]. The innovative learning approach derived from EG possesses educational values or even different kinds of software applications that compile into knowledgeable aspects such as teaching enhancement, assessments, and evaluation of learner [18].

The objective of this chapter is to comprehend game design elements that are scattered in literature for designing EGs and reflect their practicality to game design fundamentals established in prominent books by leading game designers/scholars: (1) *The Art of Game Design* [7]; (2) *Educational Game Design Fundamentals* [8]. With that, the discussion on how game design elements can be categorized and the need of reducing the duplication of elements that already exist is discussed. Therefore, this chapter attempts to provide a holistic idea based on how theoretical frameworks/models consume game design fundamentals established and how the collaboration between the designing process of EG and software design can provide a promising impression. Lastly, future direction and recommendations provide an understanding of the current approach in research for game designers, teachers, educators, and software engineers.

2. Background

As observed by leading game designers, the essence of a “game” is a problem-solving or a puzzle-solving with which competence is developed through a trial-and-error and exploration learning practice [7, 19]. Players choose from the choices

they experience in real-world and learn from those actions and feedback provided by the game, leading to an interactive learning experience. EG's remarkable motivational power includes challenges that thrill and excite players, teach, and master achievements: "It is the act of solving puzzles that makes games fun. In other words, with games, learning is the drug" [19].

2.1 Recent movement through game design frameworks and models

An interesting theoretical framework for serious game design explores to integrate the "balance" between pedagogy and game design process [20]. It is comprised of play, pedagogy, and fidelity whilst discussing theoretical grounds on constructivism; however, the paper clearly demonstrates the overarching challenges faced in order to combine interdisciplinary element and the nature of the game. The complication arises when the "balancing" between elements such as skills with challenge or fidelity with pedagogy or fidelity with objectives of pedagogy and play is placed in one design process. The framework does embark towards the idea of combining multiple disciplines to provide a guideline for educators and game designers to visualize game design process based on three major elements of designing games; the framework needs to provide testing and evaluating procedures to inform how it can be used whilst the game is undergoing a process of design.

Another exciting theoretical framework for instructional design of a game was proposed as "gaming the system" [21], which consisted of structural elements and dynamics of designing a game through three (3) levels: first, micro level which describes the problem-solving or challenges faced by the player and achieving skills or learning outcomes through motivational and exploratory learning; second, macro level describing the fiction and scenarios of the game, whilst looking at enhancing learner's identity and gameplay strategies that are adopted by the learner and satisfying the motivational aspect of learning through experience; and third, metalevel that is divided into the builder and social level, focusing on contributing to game and learning design skills and social experience and social identity of players. Another study provided a conceptual framework for adapting collaborative multiplayer games by adopting the concept of multiplayer games and gameplay design principles [22]. First, it is built on an existing model of players to provide insights into the audience, and then, it develops a typology of gameplay themes to help designers with conceptualizing actions on the screen. Finally, it provides a framework with five main game design components, namely, learning objectives, story, 3D world, gameplay, and evaluation.

Recently, two highly sophisticated types of research were published on game designing. The first research proposes a hybrid theoretical framework that analyses a few existing design models, the learning theories embedded in them, and the user experience component [14]. The hybrid framework is content specialist (puts developers and designer's perspectives), contains educational goals and technological aspects required around designing a game, and provides an iterative design process throughout the stages to ensure pre-production, production, and post-production are polished and enhanced. Not only that, the model includes a pedagogical approach and learning theories. Despite an immense study conducted, it is still a work in progress, and the model needs to be verified or validated through the designers and developers to ensure its practicality, and also the genre of games is serious; hence, the confusion on understanding educational games and serious games is still ambiguous.

Another recently published work on proposing an architecture of serious game design and assessing the technology establishes through emphasizing the engaging

and motivating needs of game design through knowledge of learning domain [23]. Along with that, pedagogy and game design components and their collaboration between domain content and pedagogical and playful experts lead the architecture to propose a taxonomy, representing a functional architecture for supporting the conceptual design of the game. With the help of the architecture designed, the paper reports that modification of decisions of the educational robot with affecting a game, and responding to new updates to improve games or even reusability of the educational robot with the newly designed game, is beneficial through the domain content where playful experts share the design requirements. A concern to be highlighted reducing and encapsulating experts' intellect may seem quite interesting, but allowing domain experts to focus on their definitions and knowledge and not worrying on the playful aspects of letting game designers amend aspects without having them to acquire deep knowledge of domain content seems ambiguous and requires more testing to prove the authenticity of how a game design might be retrieved.

2.2 Four basic elements through “Elemental Tetrad” by Jesse Schell

The art of game design [7], experienced in professor and game designing, discusses two major trajectories: the game design process and own advice through “the lens”. The lens describes the concepts through which the design decisions are approached in terms of skill levels, mechanics, aesthetics, story, and also the technological composition in industry. With the 100 lenses unfolding the designing process for designers, the discussion of each chapter unfolds from designer to experience through the game and the player, and the effort of embedding each lens into a mind map throughout the book has provided an in-depth understanding to basics of the designing process.

For example, *Lens#32* The Meaning Choices (p. 181), understanding the choices provided to the player is sufficient or making the player feel in charge or *Lens#47* The Balance (p. 205) as a recommendation to apply with any occurring design problem; however, the decisions to fix the concepts and implement occur only by the decision of programmers. Not only those, *Lens#89* The Team (p. 380), *Lens#90* The Documentation (p. 387), and *Lens#91* The Playtesting (p. 401) all fall under a very relevant yet thoughtful concepts of game designers working on communicating and working respectfully, documenting the necessary concepts, and testing the play of the game through the player's perception. This means putting game designer's thought out of the testing and covering essentials for game designers and engaging the content for video games creatively through the design process.

Consequently, the fundamental elements of a game where game designers should focus on are formed in the beginning of the design process. With the four basic elements, each of which creates a specific experiential flow defined in **Table 1**.

To explain **Figure 1**, it is crucial to mention that there is no element developed independently. They all interrelate with each other, despite the type of game being designed. For example, when you choose a set of mechanics as crucial to your gameplay, you will need to choose technology that can support them, aesthetics that emphasize them clearly to players, and a story that allows your (sometimes strange) game mechanics to make sense to the players. Consequently, choosing mechanics that make players feel like they are in the world is related to defining aesthetics. A story with a set of events lets your aesthetics emerge at the right place and have the most impact. Like any storyteller, you will want to choose aesthetics that help reinforce the ideas of your story and technology that is best suited to the particular story that will come out of your game. The technology is essentially the medium in

#	Basic element	Definition
1	Mechanics	The mechanics of the game refer to the set of rules and procedures which regulate the players' performances to achieve the goals of the game. In fact, what differentiates between more linear entertainments (such as book, movies, etc.) and games is the element of mechanics and their vital role to complement other elements of "aesthetics", "story", and "technology"
2	Aesthetics	As the name suggests, this element is very much related to how the overall environment of the game looks. Aesthetics are considered to be an exceptionally important aspect of game design because of their direct positive correlation to the players' experience. In order to help players grasp an assured feel of the game and truly immerse in the story, a certain visual technology needs to be adopted to intensify the aesthetic features of the game
3	Story	Game story refers to a series of events and the way they unfold throughout the game. This process could be either linear and predefined or emergent and in a bifurcating manner. There exists a close relation between the game mechanics and the story, as the former can pave the way for a powerful emergence and unfolding of the events in the latter
4	Technology	Represents the set of tools, resources, and know-how needed to bring the game to life. Technology is related to any form of these elements, from crayons and duct tape used in your first prototype. It is the very medium of your game where technology aesthetic elements are implemented. Highly important for the final outcomes of the game

Table 1.
The four basic elements of games and their definition, adapted from [7].

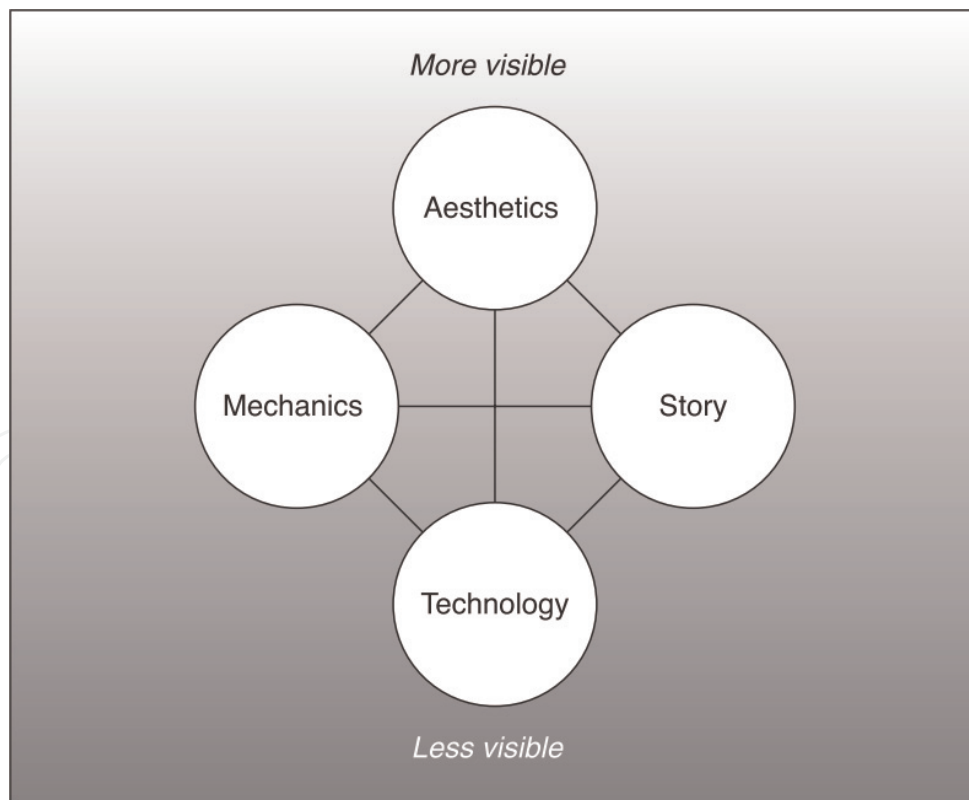


Figure 1.
The Elemental Tetrad adapted by [7].

which the aesthetics take place, in which the mechanics will occur, and through which the story will be told.

The mind map includes 30 bubbles to represent new element emerging from each chapter, and 100 lenses provided can be a very overwhelming information for

the game designing team, who needs an urgent answer to the problem-solving or iterative approach. Despite the content list provided, it is noticeable to be confused with some identifications of the lens names. To conclude, a creative involvement of game systems and the player works along to endorse the experience, whilst addressing crucial organizational perspective in relevance to software development methods such as spiral model, rapid prototyping, and playtesting.

2.3 Five basic elements through “Elemental Pentad” by George Kalmpourtzis

The Educational Game Design Fundamentals by an educator, game designer, founder, director, and board member of several European design studios presents a comprehensive how-to guide on design and building world-class educational experiences [8]. It combines the evolvment, pushing through concepts and learning throughout the process by providing the reader the stand on “Games are principles and not rules” (p. 7). Although rules are elaborated on their own entirety (pp. 169–180), “rules” are illustrating that games present rules in operational constitutive and implicit way, rules present goals, and rules define ways of punishment and rewards. Kalmpourtzis highlights that game designers have the magical power to deal with challenging tasks during the educational game design process. Hence, referring to his magical triangle (p. 54), players, game, and learning aspects to structure basic elements and their relationships to create games evolve through the chapters. The emphasis on the designer’s struggle to ensure that the balance is maintained in the system between the realistic and imaginative context of design is rather fruitful. Explaining that games consisted of objects and placing the objects as elements to be implemented in the game lead to the betterment of gameplay (p. 181).

“Game Core”, being the most interesting establishment, discusses the concrete basis of any game design based on the axis of the magical triangle and provides three approaches to designing a game (p. 119): the unbreakable core, the flexible core, and the hybrid core. In the same context, the perspective discussed that prototyping is a key element of game design, evaluating what has been completed theoretically as well as practically. Nevertheless, Kalmpourtzis highlights that

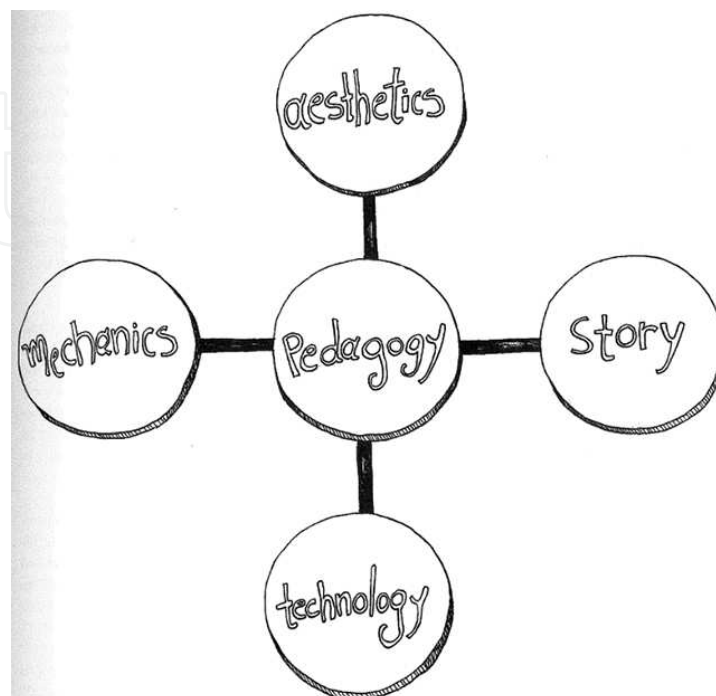


Figure 2.
A representation of the elemental Pentad adapted from [8].

interdisciplinary game design is always the most challenging aspects, i.e. an engineer working with a game designer will differ in terms of the application of the methodology to be used in building the game. Coexisting is nearly impossible in many cases, yet there is always a way to try and provide a common language as a “tool”. In relation to structuring and prototyping (the fastest and easiest way), there is an evaluation of game strategies discussed which were rather general and have been published in the previous article as well [24].

The observation by Kalmpourtzis [8] understood that Schell’s four basic elements collaborate and rely on each other’s presence highly likely. However, Kalmpourtzis believes the need of “pedagogy” as the fifth element that is highly required in the basic fundamental elements of EG. All the elements are interrelated with learning aspects that are required to be broken down as educational game design is being implemented. He explains the crucial role of educators and their experience related to pedagogical approaches and learning theories. He examines prominent learning theories such as behaviourism, cognitivism, and constructivism. Therefore, **Figure 2** shows the extension of elemental Tetrad to Elemental Pentad.

Books	Schell [7]	Kalmpourtzis [8]
Uniqueness	<p>Design aspects:</p> <ul style="list-style-type: none"> • Mechanics • Aesthetic • Story • Technology <p>Lens # 100 – mind map for designers to unfold the design process</p> <p>Games are created through:</p> <ul style="list-style-type: none"> • Playtesting • Prototyping <p>Documentation has a purpose (though does not exist) (see Chapter 24):</p> <ul style="list-style-type: none"> • Memory • Communication 	<p>Educational games design specific and design principles</p> <p>Magical Triangle:</p> <ul style="list-style-type: none"> • Players • Game • Learning aspects <p>Game Cores (three of the designing processes):</p> <ul style="list-style-type: none"> • Unbreakable • Flexible • Hybrid <p>Common language tool required</p> <p>Key considerations of designing and evaluating process:</p> <p>Prototyping</p> <p>Pedagogy and games discussed through major learning theories:</p> <ul style="list-style-type: none"> • Behaviourism • Cognitivism • Constructivism • Inquiry-based • Project-based
Difference	<p>Discusses:</p> <p>Designer’s thoughts (lens) – 100 different ways to reflect and question whilst designing the game</p> <p>Essential game components</p> <p>Engage player through experience</p>	<p>Discusses Schell’s design aspects and adds to four elements:</p> <ul style="list-style-type: none"> • Pedagogy <p>Documentation for designing games:</p> <ul style="list-style-type: none"> • Formally structured • Provides content to follow a syntax of the document
Concerns/absence	<ul style="list-style-type: none"> • The mind map has 30 different points to understand which is confusing for designer’s iterative work rules • Lens names are partly confusing and could be organized better • Documentation template does not exist 	<p>Author highlights:</p> <ul style="list-style-type: none"> • Coexisting and interdisciplinary designing are nearly impossible • Common language “tool” required

Table 2.
Similarities, differences, and concerns noticed in the studies.

Evaluating games using usability, playtesting, and quality assurance approaches can highly coexist with software engineering approaches. Lastly, the documentation chapter (p. 325) had a new and interesting projection of how game design document shape through the designing phase, despite mentioning the difficulties faced by designers in communicating their voice formally and that the structure of the document is never the same. There are three types of documentation: the classic document (one or more documents), the wiki (online with indexed searches), and the forum (participatory process) (p. 327).

To conclude the discussion of game design fundamentals, “lens” of game design, and educational game design fundamentals and cores, **Table 2** summarizes the key movement from 2008 to 2018. This shows how the published work from game designers and theorists in the field. One prominent movement can be seen that 2008 presents a non-existing template with a slight interest in documenting the designing process, whilst in 2018 a formal structure has been proposed by Kalmpourtzis [8].

3. Recent educational game design elements

EG designed for learning is a division of both play and fun. Another author defines EGs as a melding of educational content, learning principles, and computer games [5]. Another definition by [25] in [26] defined it as a learning system, which realizes some or all components of the learning process (learning theory, gaining skills and experience, and estimation of knowledge level) in a game context. EGs have been specifically designed to teach people about a certain subject, expand concepts, reinforce development, understand historical events or cultures, or assist them in learning a skill as they play [27]. Generally, EG is a game that combines both game design principles and learning theories with the integration of learning content of the specific subject or learning outcomes purposely to enrich learning for intended audiences.

Games deliberately designed for education definitely requires some degree of effectiveness in order to be accepted by stakeholders. Researchers suggested that effective games should combine good game design and good pedagogy [28, 29]. Game design has similar concepts applied in entertainment games that should be adapted into EGs, so it can offer certain degrees of engagement as it is in entertainment games. Game design with a fun aspect includes challenges, goals, feedback, and game story. These elements derive the concepts of the game as described by various authors [30, 31]. These elements are said to be crucial in a game to really behave as a game [5, 29, 32–34]. Without those elements, games cannot really be claimed as a game, but rather similar to edutainment concepts as suggested by [35].

The explosion on game design elements in research has been clearly creating duplication of some existing elements proposed previously. This not only causes confusion but also leads to a misunderstanding of many other elements and their importance in EG. The following are a few highly prominent design elements with their definitions to demonstrate their distinctive role in games.

Table 3 shows the elements that are required for an effective video game, adapted from [10]. **Table 4** defines the core elements of a well-designed EG that enhance the design of educational games [36]. **Table 5** defines the game design factors [17]. **Table 6** shows the key elements for designing an educational video game [37].

Game design (GD) being defined and established with a variety of game design elements and learning theories in EG is explicitly mentioned in [17]. **Table 5** shows examples of game design elements that are crucial. Similarly, GD is equipped with

Elements	Definition
Edutainment	Edutainment games are those which follow a skill and drill format in which players either practice repetitive skills or rehearse memorized facts
Motivational attribute	Motivation to play is a significant characteristic of an educational video game to provide rewards. Motivation also leads to the activation of efficient cognitive strategies for long-term memory issues like monitoring, elaborating, or organizing information. On the opposite side, resignation and motivation have negative results on memorization and personal development
Goals and rules	Goals in effective video games: finding that goals of different levels help motivate learners to continue playing
Narrative context	It provides the proper context for the two processes of “learning” and “problem-solving” to take place. Providing an optimum narrative context helps players to either identify or construct patterns of cause and effect in the game through which they can connect what is “known” and what is “speculative” or “abstract” within the story [38]
Interactivity	Interaction between the player and the game environment is another element embedded in the narrative context and game objectives. The best games are “highly interactive, deliberately generating tension between the degree of control the story imposes and the player’s freedom of interaction” [39]
Multisensory	“Multisensory cues can engage learners, direct their attention to important behaviours and relationships, help them understand new sensory perspectives, prevent errors through feedback cues, and enhance ease of use” [40]

Table 3.
The elements of an effective video game [10].

Elements	Definition
Interactive problem-solving	A continuous interaction between players and the game, made possible through a series of problem-solving tasks
Specific goals/rules	Incorporation of a set of rules to define the “what” and “when” of the players’ actions which allow the achievement of a set of implicit or explicit goals in the game
Adaptive challenges	This is what differentiates between good games and the best games. The former maintains a balance and a comfort zone between the game challenges and the players’ abilities. In the latter, the game goes one step further to introduce a challenge right at the edge of students’ abilities
Control	Providing opportunities to inspire players’ influence on the gameplay, the environment, and the overall learning experience
Ongoing feedback	Providing apt and relevant explicit or implicit feedback on players’ performances with the purpose of improving the learning experiences’ outcome
Uncertainty	Creating a sense of “suspense” and therefore provoking more player engagement with the game. A clear-cut conveyance of the game outcome will reduce the game’s allure and attraction
Sensory stimuli	Refers to the interplay of the graphics, sounds, and storyline (not necessarily in a compellingly “professional” state) with the purpose of provoking players’ senses

Table 4.
The seven (7) “core elements of a well-designed EG” [36].

learning characteristic that adds the value of providing a good learning experience to learners. The authors presented a macro design concepts [17] that reveal 11 crucial game design factors (**Table 6**): (1) game goals, (2) game mechanism, (3) game fantasy, (4) game value, (5) interaction, (6) freedom, (7) narrative, (8) sensation, (9) challenges, (10) sociality, and (11) mystery.

Factors	Description
Game goals	Providing the correct game experience for the players to pursue relevant goals
Game mechanism	Methods through which designers' goals are transferred to and achieved by the players to allow for a smooth operation of the virtual world
Interaction	Generation of relevant interactional and conflict feedback by the computer according to players' performances during the game
Freedom	Acknowledgement of player autonomy and agency in the game space, such as creation of avatars
Game fantasy	Game context which allows for the provision of virtual and imagery effects
Narrative	Describing event occurring in the virtual world
Sensation	Presentation of the virtual world through multimedia elements
Game value	Defined as the potential to increase players' game motivation
Challenges	Players' efforts to overcome/achieve game obstacles/goals
Sociality	Creating opportunities for interaction among players to promote communication, cooperation, competition, and/or conflict
Mystery	Maintaining a sense of curiosity and mystery through creation of novel and unique experiences

Table 5.
Eleven game design factors by [17].

Another recently published work highlighting the key elements for designing an educational video game or the crucial elements for narrative content that can enhance the educational aspect of the game are provided [37] (see **Table 6** for the definitions).

Key elements	Definition
Game structure	<p>Act: much like a theatre play, act refers to each main part of the game into which the storyline is divided. There has to be at least a minimum of one act and a potential maximum</p> <p>Scene: different subdivisions of an act entailing an introduction, a plot, and a climax for each act</p> <p>Action: different subdivisions of a scene describing events in the game storyline. Each action may bear certain educational challenges</p> <p>Dialogue: any action corresponding to a conversation between game characters</p>
Scenario	A two- or three-dimensional visual representation within which scenes can take place. There is no one-to-one relation between scenes and a scenario, so multiple scenes can occur in one scenario, or a particular scene can signify a change of scenario
Characters	Entities of the scenes performing actions and dialogues, of whom both the physical appearance and personality traits need to be designed. Normally, the player's avatar will be assigned the role of a protagonist (hero of the game). The presence or absence of the avatar can also be defined by the first-person or third-person narration of the story
Interactive objects or active parts of the scenarios	Objects of props to which some kind of functionality is allocated. These can be collected by the avatar and saved in their inventory. The assigned functionalities of the objects can later be utilized to further the purposes of the game
Educational competences	A set of skills and personal dispositions defined in a specific curricular context. For example, the Spanish Education System defines eight

Key elements	Definition
	competencies such as linguistics communicative, cultural and artistic, mathematical, etc.
Educational challenges	Challenges designed by pedagogical experts with the purpose of providing space of the development of those competences according to the proposed educational curriculum
Sounds	Includes all the acoustic features of the game: voices, effects, and music
Gameplay or the set of game rules	An underlying connection of a specific concept to a specific game genre with the purpose of regulating players' interactions with game mechanisms, which would eventually lead to the accomplishment of educational objectives, whilst maintaining a satisfactory gaming experience
Adaptation	A mechanical and instinctive adjustment of the game based on players' performance. It necessitates understanding the adjustable and configurable elements of the game by getting feedback from the players' profile, such as method of interaction, educational challenges and assessment, and the narrative.

Table 6.
 Key elements for designing an educational video game [37].

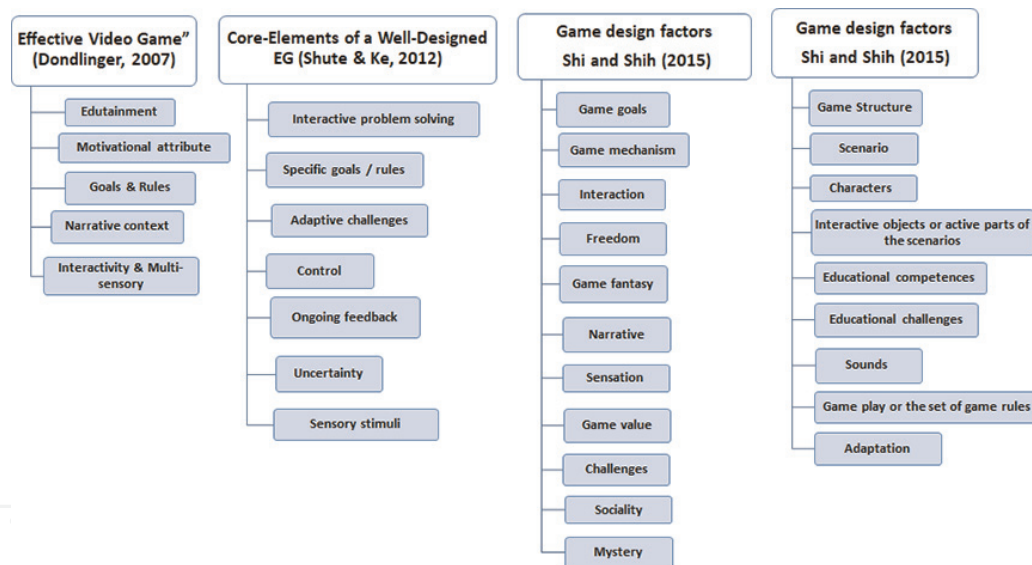


Figure 3.
 Adapted from elements of an effective video game [10], core elements of well-designed games [36], game design factors [17], and key elements for designing an educational video game [37].

Figure 3 accumulates the game design elements discussed in details above. **Figure 3** is designed in this chapter to provide a clearer overview of the list of elements discussed before proceeding into grouping in Elemental Pentad.

4. Solution and recommendation

To understand the majority of game design elements and their need in designing a game is a tough task. The game design elements discussed in this chapter are understood and mapped onto the Elemental Pentad (**Figure 2**). Based on the definitions of the fundamental elements (Elemental Pentad) and the definitions of the

design elements from various research, careful observation on their definitions draws onto the idea of grouping a large number of elements onto five main fundamental elements. This way, it will allow game designers to be able to distinguish the categorized elements in different key elements and the fundamentals of the game design process from the start of their process.

The elements are grouped under the five (5) main fundamental elements as shown in **Figure 4**. The elements are grouped into fundamental elements to provide a broader way of approaching the elements of educational game design as it is an entirely a challenging task. Game designers are required to have various skills where they should be able to listen and observe, knowing the fact that games are not the only solution to everything, they should be able to communicate and present their ideas through various mediums with other team members who are not game designers, and they are constantly learning. Not only that, but they are also aware of the context in which they have to integrate the learning perspective. However, their views and experience are entirely different from the views and experience a teacher or an education would preserve.

With the scattered game design elements and continuous exploration of research, the academicians are required to understand that the duplication of elements is only leading to a more confusion pattern. This chapter covers only the very prominent studies, which published elements that can provide an effective video game, or the core of an EG to be a well-designed element required a number of elements or the game design factors that need to be considered in designing an EG. The key elements for designing an EG proposed [37] provide an overview of how distinctive it is with designing a game. EGs are comprised of a fundamental element, pedagogy. Pedagogy is what seems to differentiate the game characteristics of EG vs an entertaining game. Hence, designing an educational game is not getting any easier.

With respect to that, this chapter intends to accumulate a few scattered game design elements and group them onto Elemental Pentad (**Figure 4**). The categorization provides a range of aspects to visualize a few crucial features.

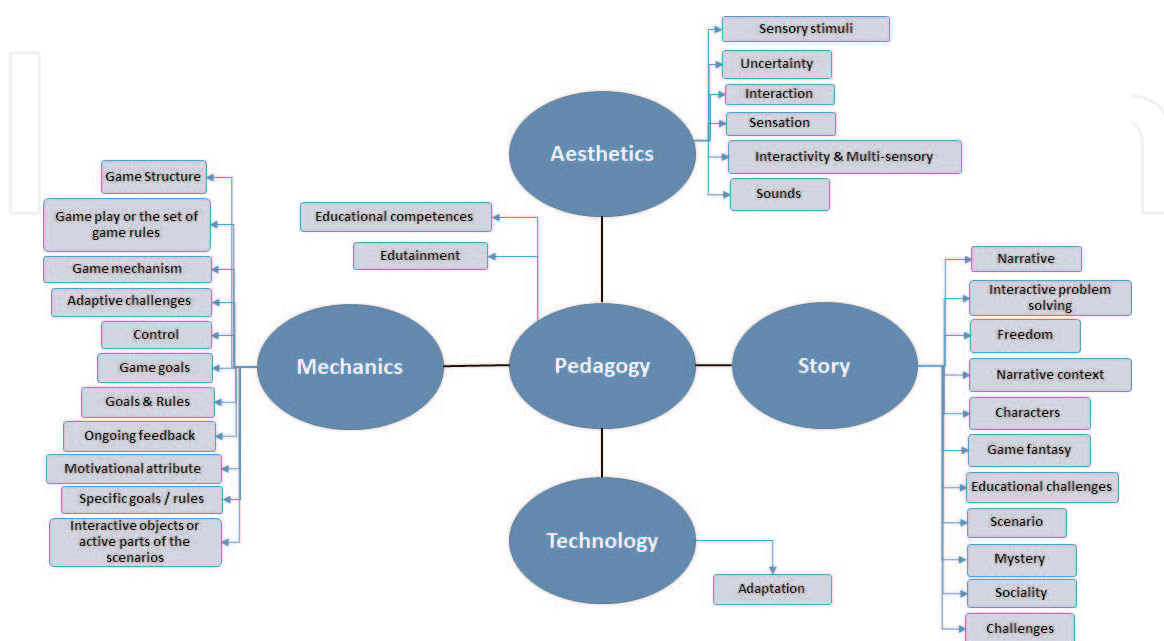


Figure 4. A proposed categorization of game design elements onto five fundamental basic elements of an educational game.

1. Only “Key elements for designing an Educational Video Game [37]” mentioned design elements for fundamental element pedagogy.
2. Repetition of elements under fundamental element mechanics:
 - a. Goals
 - b. Goals and rules
 - c. Specific goals/rules
3. Repetition of elements under fundamental element story:
 - a. Narrative
 - b. Narrative context
 - c. Educational challenges
 - d. Challenges

Although there still seem to be duplicate or ambiguous elements under the mechanics fundamental element, it opens a room for discussion on a few crucial matters in the research. Under the story fundamental element, the design element challenges and educational challenges seem to be repetitive. This is due to the fact that some elements are referred to as general concepts in designing a game and some are referred specifically for EG. Exploring game elements is a tedious task, and it requires a deeper understanding to why there is a duplication in elements being proposed and why the Elemental Pentad proposed is not being used to provide a definite understanding for all types of game team (stakeholders).

This now opens the research to understand that, despite an emerging range of game designing elements and models and frameworks to assist game designers, teachers, and game developers to understand the need of educational aspect, there is a need to reduce duplication, reducing the confusion of existing work and new proposed work in designing educational games. Below is the list of a few projections that can be pursued and how the researchers should be able to understand these gaps. With the understanding, there is a need to comprehend:

1. The terms used to describe games as educational game design requires a categorization.
 - a. Well-designed games, effective video game, educational games, serious game?
2. The number of emerging game design elements is being produced rapidly, and hence, duplication occurs.
 - a. Understanding why some researches define game designing elements as:
 - i. Elements?
 - ii. Factors?

- iii. Key elements?
 - iv. Core elements?
 - v. Effective elements?
3. There is a need to remove or reduce duplication of design elements to avoid confusion.
 4. Categorization may assist the game designers to keep on track, despite overwhelming challenges exist, including “common language” that could help communicate with the team members.
 5. Stakeholders including educators, teachers, and also learners can reflect with the elements and relate their experience to ease game designing task.

5. Conclusion

This chapter discusses a few prominent game design elements published over the past decade and intends to group them onto established fundamental elements (Elemental Pentad). This is to demonstrate an easy projection on selecting the game design elements for designing process of educational games. This research will continue the grouping of elements to enhance the proposed grouping in this chapter.

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