Interdisciplinary Journal of Virtual Learning in Medical Sciences

Review Article

Investigating the Components of Educational Game Design Based on Explorer Player Style: A Systematic Literature Review

Mahsa Moradi[1]*, PhD candidate; Khadijeh Aliabadi[1], PhD; Mohammad Reza Nili Ahmadabadi[1], PhD; Saeid Pourroostaei Ardakani[1], PhD; Yousef Mahdavi Nasab[2], PhD

[1]*Department of Educational Technology, Faculty of Psychology and Education, Allameh Tabataba'i University, Tehran, Iran*
[2]*Department of Educational Technology, Faculty of Psychology and Education, Kharazmi University, Tehran, Iran*

ABSTRACT

Background: Game-based instruction is one of the methods that encourage exploration among learners. Identifying and incorporating exploratory components should be considered as a principal goal in designing a game that provides exploratory instruction. The present study aims to investigate the exploratory components of an educational game.

Methods: A systematic review of the literature was performed in accordance with PRISMA guidelines. Based on the inclusion criteria, a comprehensive search was conducted in Google Scholar, ProQuest, ScienceDirect and Scopus for articles published between 1995-2019. A combination of keywords were used in the search, including (''educational game'' OR ''serious game'' OR ''adaptive game'') AND (''player type'' OR ''player style'' OR ''player modeling'' OR ''Bartle player style'' OR ''explorer player''). A manual search was also conducted in Google to identify more literature. Furthermore, out of 1034 articles, 39 were studied in depth.

Results: The obtained components were categorized in six sections, including: educational elements (research, serious game, project-based activities, test hypotheses, question and answer, role play, simulation), exploratory dynamics (exploration, solving, collecting, and build), mechanics (chance, conflict or challenge, collaboration [negative relationship], prizes upon completion, non-linear space, existence of creative tools, existence of ancillary equipment, guidance, open content, customizability, access to all facilities, different ways to study elements and environment, and puzzle), aesthetics, branch stories and proportionality, exploration-based games (emphasis on the pivotal challenge to success, emphasis on meaningful choices, emphasis on thinking versus physical work, emphasis on longer game sessions, no punishment, emphasis on freedom versus control, emphasis on details versus imagination).

Conclusion: Designers can draw on these components when developing a game that suits the learners' styles. Analysis of the studies showed that the obtained components could be used in educational game design, and the obtained framework is a useful guide for game designers.

Keywords: Educational Game Design, Explorer Player Style, Bartle Player Styles, Discovery Game

*Corresponding author:
Mahsa Moradi, PhD candidate; Department of Educational Technology, Faculty of Psychology and Education, Allameh Tabataba'i University, Tehran, Iran
Tel: +98 9109952528
Email: mahsa_moradi@atu.ac.ir

Please cite this paper as:
Moradi M, Aliabadi K, Nili Ahmadabadi MR, Pourroostaei Ardakani S, Mahdavi Nasab Y. Investigating the Components of Educational Game Design Based on Explorer Player Style: A Systematic Literature Review. Interdiscip J Virtual Learn Med Sci. 2020;11(3):139-152.doi:10.30476/ijvlms.2020.85494.1022.

Received: 16-06-2020
Revised: 13-07-2020
Accepted: 25-07-2020

Background

Exploration-based learning encourages the learning process, and this type of learning takes place by interacting with the environment, asking questions, and doing experiments (1). In exploration-based learning, students engage in a wide range of activities to optimize their knowledge, including observation, experimentation and reasoning (2). Bruner believed that this type of learning facilitates transfer and retention, increases problem solving, promotes the reasoning process, and supports motivation (3).

A significant new approach in exploration-based learning is to use games, especially computer games (4-9). The proponents of exploration-based learning argue that computer-based games have the ability to encourage active and profound learning in exploratory contexts (5). Despite the suitability of computer games in providing exploration-based learning, achieving this aim requires an educational design based on the gamers' conditions.

In this regard, Kapp (10) argues that in designing educational games, one should consider the gaming styles of various gamers, since different individuals have different preferences in gaming. One person might enjoy a specific aspect of a game, while others do not necessarily enjoy it. Bartel (11) claims that people play for different reasons; whereas some people come together and play to develop friendly relations and interactions, others play solely to win. He maintains that there are four types of gamers:

Killler: People who like to compete with others.

Achiever: People who like to have some achievements in the game.

Socializer: People who like to make friends with others.

Explorer: People who like to search and collect artifacts.

Explorers are the people who tend to interact with the world. These gamers usually focus on the gaming experience. Hence, they are interested in experiencing each part of a game. Dorner et al. (12) point to their desire to know the game environment, learning new things, and looking for amazing things in the games (12, 13). In fact, they are the experts in the game world and are even more familiar with a game than the creators of that game (14).

While Bartle introduced four types of gamers mainly in the field of online multiplayer video games, other researchers made similar efforts with regard to serious games (educational games). Klawe (15) identified two types of gaming styles in the field of education; he introduced these two categories of gamers, namely the children who seek to quickly win in games, and those who prefer to explore the environment (15, 16). In their classification, Bateman and Boon (17) also introduced four play styles, that is Type 1 Conqueror, Type 2 Manager, Type 3 Wanderer, and Type 4 Participant. In all the above-mentioned studies an explorer style can be identified, and since explorers and exploratory methods have been neglected in training and educational designs, especially in Iran, this style was selected for a systematic review.

In their research entitled "Beyond Player Types: Gaming Achievement Goal", Heather et al. (18) proposed a new approach to classifying players based on their mastery and goals to achieve in the game. Four types of player styles were examined, namely super achievers, mastery-only, performance-only, and non-achievers. They also examined the relationship between these four types of players and compared their goals with that of traditional winners and exploring players. The results indicated that the interest in exploring and discovering things could exist in any of the four types of players studied, but those with strong desire for dominance had the least interest in exploration.

In a study entitled "Towards personalized, gamified systems: an investigation into game design, personality and player typologies", Ferro, Walz and Greuter (19) have examined the relationship between player types and personality traits. They identified the possible relationships between the two areas of the research by examining player-type models

as well as personality traits and personality type models. As a result, they presented a table that identifies possible relationships between player types, personality traits, and game components and game mechanics, and discussed whether these relationships affect the design of game systems or not. Finally, they suggested 5 categories of player styles (Dominant, Objectivist, Humanist, Inquisitive, and Creative). Konert et al. (20), In their study entitled "Player, Learner, and Personality Modeling: The Independence of Bartel, Kolb, and NEO-FFI Models and the Consequences of Game-Based Learning", examined a hypothesis that suggests that Bartel's player styles and Kolb's learning styles can be predicted based on the Neo test. In the end, the independence of the models and the validity of the dimensions were proven. Therefore, it is not possible to predict Bartel's player styles and Kolb's learning styles based on the NeoTest. In summary, the study found that predicting Bartle's playing style preferences or Kolb's learning style preferences is not possible through Neo's personality test. At least no such conclusion can be drawn based on the study data described here. However, the results indicated that some of the relationships are notable, including a significant relationship between Kolb's component of thinking and Bartel's component of achiever, a significant positive correlation between Neo's component of Conscientiousness and Bartel's component of Socializer, and a negative relationship between Neo's agreeableness style and Kolb's Experiencing style.

In their research, Dong et al. (1) used exploration-based learning games to provide training for using a software program. They asked the participants to complete a jigsaw puzzle using the tools in Photoshop. Researchers conducted an eleven-person laboratory study of the initial version, and found that the game is an effective learning medium. Participants not only learned new tools and techniques, but also remembered the techniques they had learned before but had forgotten.

Despite the conducted studies, there are still various research gaps in the area of designing effective educational games based on playing styles. For instance, in spite of the arguments about the potential educational effectiveness of narrative-based adventure games, further evidence is required on how to build effective exploration-based educational games (9). Also, many studies have revealed the limitations of the approaches to exploration-based learning in education and training (21).

Furthermore, Mayer and Harris (22) and Sangsawang (23) emphasize the importance of educational design, and assert that professional training requires scientific and practical methods. Each approach requires a unique educational design framework, and the need to take note of educational design in educational games is one of the concerns of the experts in the field of education. Nevertheless, as Isbister et al. (24) observe, almost 30 years into video games, there is still a lack of cognizant and systematic discussion about design principles for creating effective and entertaining learning games. Also, Bontchev et al. (16) confirm this and point to the lack of a systematic perspective on the design of educational games as one of the challenges in designing these games.

Therefore, lack of attention to new educational methods and educational design, as well as unsuccessful designs and non-systematic principles can be significant factors in the failure of educational game production projects. In the light of what has been discussed so far, and considering the different categories of players and the significance of different playing styles in the design of educational games, there is little research on game design in accordance with learners' playing styles. Therefore, this study provides a systematic review of the existing literature with the aim of identifying the components of educational games in accordance with player styles (exploration-based style).

Research Questions

Q1: What are the elements in designing an

explorer game?
Q2: How to proportionally incorporate game elements in designing explorer games?

Methods

A systematic review of the literature was conducted and the articles were selected in accordance with PRISMA guidelines. Four databases, namely ProQuest, Scopus, ScienceDirect, and Google Scholar, were used to identify the related works.

The initial search was conducted in September 2018, and the final search in 2019. This search was performed using a combination of the following keywords: (''educational game'' OR ''serious game'' OR ''adaptive game'') AND (''player type'' OR ''player style'' OR ''player modeling'' OR ''Bartle player style'' OR ''explorer player''). A manual search was also conducted on Google to identify more literature.

Inclusion and Exclusion Criteria

The works that were studied in depth were in the areas of player styles and the components of explorer player styles. The time period of the search was from 1995 to the time of the search in 2019. Research and review articles, dissertations, treatises and conference papers were used in this systematic review, but the book chapters, the text of the newspapers, and the commentaries were excluded from the research process. The inclusion criteria included:

- Any article that presents a model of player types in digital games.
- Any article that focuses on video game environments to identify the characteristics of different types of players.
- Any article that discusses different motivations of players in video games.
- Articles in the field of educational games.

Exclusion criteria were as follows:

- The full text of the article was not available.
- The text was not written in English.
- Duplicate article
- Newspaper texts and speeches

3. Results

The search and selection process were based on two topics, namely educational games (Topic 1) and player styles (Topic 2). This process is presented in Figure 1. A total of 1,067 articles were identified using the aforementioned search strategies. The results

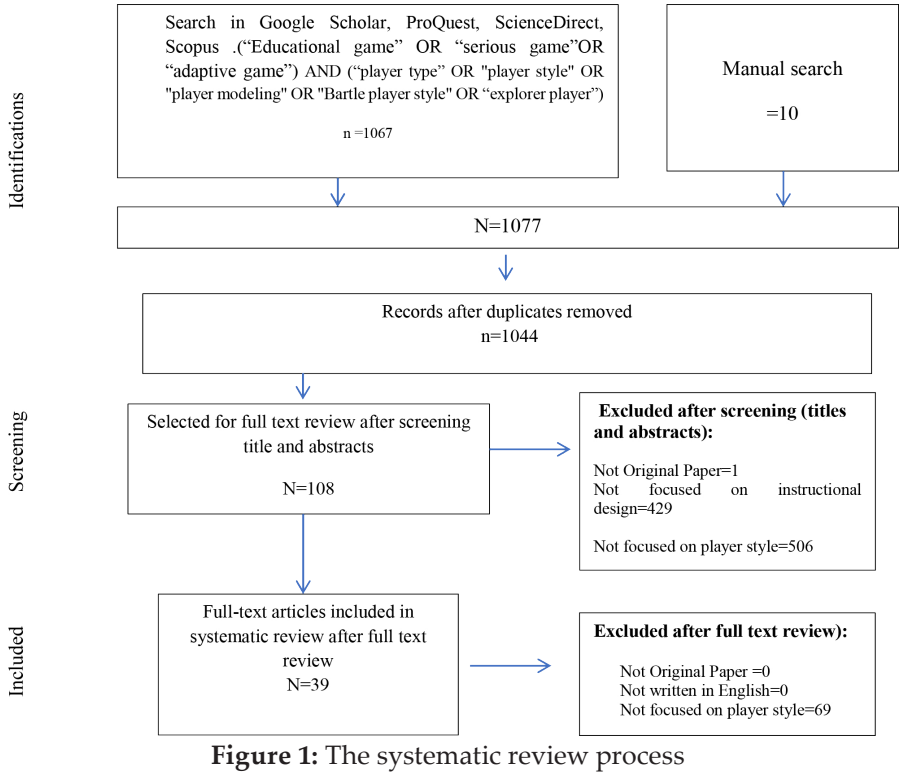

Figure 1: The systematic review process

of the searches in each database are reported in Table 1. Another ten articles were found in the Google search. In the next step, all duplicate results (N=33) were identified and removed. In total, 266 articles were left after reviewing the titles and abstracts. Finally, 108 articles were selected for a full-text reading. However, as summarized in Table 2, 39

Table 1: The results of keyword searches in the databases

Database	Number of topics 1 (educational games)	Number of topics 2 (player styles)	Combination number
ProQuest	2971	564	65
Scopus	10482	534	62
ScienceDirect	2060	1448	52
Google Scholar	17300	9280	888
Total	32813	11826	1067

Table 2: Components obtained from the systematic review of the literature

Components		Authors	Year
Educational Elements	Research	Pirker (25)	2017
	Serious game	Bontchev (26)	2018
		Fortes Tondello (27)	2016
	Project-based activities	Monterrat (28)	2017
	Test hypotheses	Heeter (29)	2008
		Heeter et al. (18)	2011
		Pirker (25)	2017
		Darby (30)	2019
	Question and answer	Bostan (31)	2009
	Role play	Yee (32)	2005
		Hynninen (33)	2016
	Simulation	Bontchev (26)	2018
Mechanics	Chance	Mena (34)	2012
		Xu (35)	2015
	Conflict or challenge	Lindberg (36)	2017
		Pirker (25)	2017
		Heeter (29)	2008
		Heeter et al. (18)	2011
		Fortes Tondello (27)	2016
	Collaboration (negative relationship)	Frye (37)	2013
	Prizes upon completion	Patterson (38)	2014
		Pirker (25)	2017
		Kocadere (39)	2018
	Non-linear space	Nacke (40)	2011
		Fortes Tondello (27)	2016
	Existence of creative tools	Fortes Tondello (27)	2016
		Marczewski (41)	2015
	Existence of ancillary equipment	Yee (32)	2005
	Guidance	Patterson (38)	2014
		Monterrat et al. (42)	2015
	Open content	Fortes Tondello (27)	2016
		Marczewski (41)	2015
	Customizability	Heeter (29)	2008
		Heeter et al. (18)	2011
		Fortes Tondello (27)	2016
		Marczewski (41)	2015

	Access to all facilities	Dias & Martinho (43)	2010 ,2011
		Heeter (29)	2008
		Heeter (18)	2011
	Different ways to study elements and the environment	Darby (30)	2019
	Puzzle	Drachen et al. (44)	2009
		Bontchev (26)	2018
Story	Storytelling and branch stories	Yee (32)	2005
		Heeter (29)	2008
		Heeter (18)	2011
		Frye (37)	2013
		Hynninen (33)	2016
		Kocadere (39)	2018
		Fortes Tondello (45)	2019
	Character	Yee (32)	2005
		Dias & Martinho (43)	2011
		Hynninen (33)	2016
Aesthetics		Yee (32)	2005
		Nacke (40)	2011
Dynamic	Exploration (finding objects and places)	Yee (32)	2005
		Heeter (29)	2008
		Bostan (31)	2009
		Hynninen (33)	2016
		Rogers (46)	2016
		Pirker (25)	2017
		Darby (30)	2019
		Hanna (47)	2014
		ferro et al. (19)	2013
		Kahn (48)	2015
		Fortes Tondello (27)	2016
		Lindberg (36)	2017
		Fortes Tondello (45)	2019
		Patterson (38)	2014
		Savolainen (49)	2019
		Hanna (47)	2014
		Marczewski (41)	2015
	Collect	Hanna (47)	2014
	Solve	Drachen et al. (44)	2009
		Bontchev (26)	2018
	Search	Bartel (11)	1996
		Yee (32)	2005
		Bostan (31)	2009
		Hanna (47)	2014
		Nacke(40)	2011
		Ferro et al. (19)	2013
		Quick (50)	2013
		Monterrat et al. (42)	2015
		Xu (35)	2015
		Khoshkangini (51)	2018
		Fullerton (52)	2018

Proportionality	Emphasis on the pivotal challenge to success		Lindberg (36)	2017
			Heeter (29)	2008
			Heeter (18)	2011
			Fortes Tondello (27)	2016
			Pirker (25)	2017
	Emphasis on meaningful choices	Select branches	Marczewski (41)	2015
		Choose a lot of mechanics	Heeter (29)	2008
			Heeter et al. (18)	2011
	Emphasis on thinking versus physical work (perception and analysis		Bostan (31)	2009
			Nacke (40)	2011
			Darby (30)	2019
	Emphasis on longer game sessions		Hanna (47)	2014
	No punishment		Dias & Martinho (43)	2011
	Emphasis on freedom versus control		Harteveld (53)	2017
			Ferro et al. (19)	2013
	Emphasis on the details versus imagination		Yee (32)	2005
			Frye (37)	2013

articles were used for the final application in a systematic review.

As evident in Table 1, the number of sources stood at 62 in Scopus, 52 in ScienceDirect, and 888 in Google Scholar. Overall, 1067 articles were extracted for further assessment, and ten articles were added based on a manual search. The selection process was conducted in compliance with the inclusion and exclusion criteria, and accordingly 39 articles were analyzed in-depth (Table 2).

In this section, the findings were presented based on the analysis of published case studies. Non- statistical methods were used to evaluate and interpret the findings of the collected studies. As displayed in Table 2, a total of 39 studies were finally analyzed to address the research questions. The questions and the interpretations of the findings are as follows:

RQ1.1: What are the educational elements in exploratory game design?

1. Educational Elements

As presented in Table 2, the components of research in the area of educational elements include serious game, project-based activity, testing hypotheses, questions and answers, role-play, and simulation.

The results of the systematic review show that probe players enjoy a deep exploratory experience through discovery, experimentation, and learning (27, 37), and their primary purpose is to discover, research and experiment (25, 28). In terms of the characteristics of explorers, Heeter & Fitzgerald (29) and Heeter et al. (18) state that explorers' motivation stems from intrinsic factors, such as curiosity, role-playing, and learning. For this reason, their favorite teaching methods are active methods such as research, serious gaming, project-based activity, hypothesis testing, questioning and answering, role-playing, and simulation.

RQ1.2: What are the dynamics in exploratory game design?

2. Dynamics

According to the results, features such as exploration, collection, solving, and searching are the components under the 'dynamics' category.

- Exploration

Quick (50) maintains that the discovery component includes exploring unfamiliar places, discovering unexpected things, searching for hidden things, surprising things, chance events, and exploring the game's internal environment. According to Pirker et al. (25), the main objective of explorers is to have a profound exploratory experience that involves considerable freedom to discover surprising factors.

- Collection

Bartle (11) introduces explorers as the people who like to search for and collect artifacts. Yee (32) maintains that explorers enjoy collecting information and artifacts that are available to few people.

- Solving

As regards the 'Solving' components, Bontchev et al. (26) point to the ability to solve problems, the ability to control multiple logical and complex units, as well as the abilities of the explorer person. Drachenet al. (44) also categorized the players. They did not directly refer to the explorer style, but according to the suggested definitions, the explorer style can be considered almost equivalent to the solver style in their classifications; Solver types are skilled at solving puzzles.

- Searching

Bartle (11) and Yee (32) identify explorers as those who like to search. In their classification, Nacke, et al. (40) describe searchers in a similar way to exploratory types, in that the searchers are curious about the game world and enjoy moments of wonder. They remark that searchers are process-oriented people preferring process-oriented tendencies, and might be interested in the quality of the result, but are not as motivated to complete a process as goal-oriented people. These players pay less attention to their goals and are more interested in the quality of their direct experience. Also Xu (35) believes that search is one of the most attractive components for explorers.

RQ1.3: What are the mechanics in game design?

3. Mechanics

Based on the results, elements such as Chance, conflict or challenge, cooperation (negative relationship), prizes upon completion, non-linear space, creativity tools, ancillary equipment, guidance, open content, customization, access to all facilities, different methods for examining elements and the environment, and puzzles are among the favorite components of 'mechanics' category for explorers.

- Chance

In terms of explorers' interest in the 'chance' dimension, Xu (35) and Quick (50) state that explorers are interested in surprises and chance events. Mena (34) also declares that exploration has a lot to do with the chance component in the game environment.

- Challenge

Tondello (27) presents challenges as a critical component of game design for explorers. The key question here is how the challenges should be designed in the game. Heeter & Fitzgerald (29) and Heeter et al. (18) address this question by emphasizing that explorers do not need to be challenged, but if the challenge is to be included, they must join the in-depth of the games. The challenge for this group of players can involve collecting more information about the story and more mechanical options.

Prize Xu (35) and Kocadere (39) argue in their research that prize mechanics are enjoyable for explorers. According to Pirker et al. (25), rewarding behavior is essential for this group of gamers in a significant way. The real reward for explorers is the ability to interact with the environment in an exploratory fashion.

- non-linear space

Ferro et al. (19) contends that explorers prefer a more natural environment than a linear and structured environment. They are more inclined to engage with open worlds and start searching for specific items. Tondello & Wehbe (27) and Nacke et al. (40) emphasize that the space for game explorers should be designed to be natural and non-linear.

- Creativity tool

In his research, Yee (32) stresses the need for peripherals. One of these devices can be a creative tool in the game. Marczewski (41) also highlights the use of creativity tools in the game for explorers. He states that players should be allowed to create their content and express themselves.

- Guidance

Patterson (38) and Monterrat et al. (42) find it helpful for explorers to use tips.

- Customization

Tondello et al. (27) and Yee (32) find the customization component useful for explorers. Harteveld & Sutherland (53) examined the design principles of a game based on the players' styles. They maintain that the principles of 'independence' and 'personal identity' are important for explorers, and 'customization' is one of the essential components in observing these principles. Marczewski (41) also states that an important component for explorers is customization, and advises designers to provide players with the necessary tools for designing their own experiences.

- Access to all facilities

Heeter & Fitzgerald (29), Heeter et al. (18) and Dias & Martinho (43) emphasize that free access to game content is important and enjoyable for explorers, since they need to be able to access all features of a game and be able to move around quickly.

- Puzzle

According to Bontchev et al. (26) and Drachen et al. (44), explorers have great puzzle-solving skills, so it is better to include puzzles in the game.

- Collaboration

Another component of mechanics in game design is collaboration, which is not favored by explorer types. A study by Frye (37) demonstrates that explorers are not interested in working with other players. Therefore, in designing an exploratory game, one should avoid incorporating a process that involves cooperation among a group of players.

RQ1.4: What is the game story in explorer game design?

4. Story

Heeter & Fitzgerald (29), Heeter et al. (18), Hynninen (33), Kocadere & Çağlar (39), Dias & Martinho (43) and Fortes Tondello (45) have all emphasized the importance of storytelling among explorer players. Furthermore, Dias & Martinho (43) concluded that explorer players develop emotional connections with characters and enjoy character-driven stories.

RQ 1.5: What is the Aesthetics in explorer game design?

5. Aesthetics

The studies by Yee (32), Nacke et al. (40) and Monterrat et al. (42) have highlighted the usefulness of setting an aesthetic element into the design of exploratory games. Explorer player types take an interest in aesthetics, both from visual and audio perspectives.

RQ2: How to proportionally incorporate game elements in designing explorer games?

Emphasis on challenge versus success

As mentioned before, explorers are process-oriented. Therefore, it should be noted that, in balancing the game features, emphasis should be placed on the central challenge, not on success (18, 25, 27, 36).

Emphasis on meaningful choices

As mentioned earlier, explorers like to navigate and search through the game environment. They prefer to understand the game's reactions to their choices. Therefore, in balancing the game elements for explorers, care must be taken to provide multiple choices (29, 18, 41).

Explorers are interested in solving puzzles since they have the necessary skills in this area. Accordingly, in determining the proportion between mental and physical activities, the priority should be given to designing intellectual games and puzzle-solving activities (30, 31, 40).

Emphasis on longer game sessions

Since explorers are interested in navigating the game environment, they need a longer gaming time. It will take a long time for them to explore (47).

No punishment

Explorers are usually overwhelmed by searching and navigating the game, and are also process-oriented and do not think much about the outcome. It is, therefore, recommended to design the games without punishment (43)

Emphasis on freedom versus control

It is important to give the developer more freedom in navigating the environment and providing options for explorer types in game design (19, 53)

Details versus fantasy

Explorers are interested in making

discoveries and enjoy discovering the details of the game. Therefore, it is better for the exploratory game to be more complex and detailed (19, 32).

Discussion

Analysis of the studies showed that the obtained components could be classified into six categories, namely educational elements, exploration dynamics, exploration mechanics, aesthetics, story, and how to balance the exploratory game. This result will be further explained in the following paragraphs.

The findings of this study suggest that explorers have a great motivation to learn. The teaching methods that attract explorers' interest include project execution, experimentation, question and answer, role-play, and simulation. These findings are in line with those of Pirker (23), Fortes Tondello (24), Monterrat (28), Heeter (29), Heeter et al. (18), Darby (30), Bostan (31), Yee (32), Hynninen (33), Bontchev (26). Based on these studies, explorers enjoy learning and having a deep exploratory experience that entails considerable freedom to do experiments and make discoveries. These results are consistent with the research of Dong et al. (1) who found that discovery games are an effective learning medium. This could be attributed to the curiosity and desire to learn among explorers.

Another research finding is that explorers are interested in dynamics such as exploring, collecting, solving, and searching. They find pleasure in exploring the game environment and its resources, and in moving freely within that environment. Explorers seek to collect resources and objects that might be hidden from others because they like to take part in intellectual activities and solve complex dilemmas. These findings are in line with a number of other studies (19, 25, 27, 29-33, 36, 38, 41, 45-49), all emphasizing the explorer's interest in exploring the game environment.

Moreover, Bartel (11), Bostan (31), Yee (32), Bontchev (26), Xu (35), Nacke (40), Monterrat et al. (42), Drachen et al. (44), Hanna (47), Ferro et al. (19), Quick (50), Khoshkangini (51), Fullerton (52) argue that explorer types are the people who like to search and collect artifacts. Based on the findings of the present study, an inner motivation to understand the game and solve challenges is the reason why this group of gamers are interested in exploring, searching, and collecting artifacts. In this regard, Bontchev (26) and Drachen et al (44) considered problem-solving as one of the abilities of explorer people, and stressed that explorers are highly skilled in solving puzzles. Their curiosity about the game environment and their desire to find and enjoy exciting moments is another reason for explorers' interest in searching. Searchers are process-oriented people, who prefer the game process to the final outcome. They might be interested in the quality of the results, but not as motivated as goal-oriented people to complete the process. These players pay less attention to their goals and are more interested in the quality of their instant experiences. They are more inclined to engage with open worlds and start searching for specific items.

Given that explorers enjoy locating hidden objects, it is appropriate to pay attention to the placement of the elements of a game in designing the mechanics of that game. Chance events are the most appealing mechanics for explorers since they mostly engage in chance-based activities in the game environment. These findings are consistent with the research by Fortes Tondello (27), Heeter (29) and Heeter et al. (18), who note that explorers do not like challenges at all, except for challenges that are related to content and are explicitly designed. The challenges for this group of players can be mostly related to the story and mechanical options. The reason for preferring such challenges can be the process-oriented mentality and intrinsic motivation of these players. Based on the findings in this study and those of Pirker (25), XU (35), Kocadere (39) reward mechanics are enjoyable for explorers. Game designers should take note that the prizes are awarded after the completion of a work or activity. The real reward for explorers is the possibility of interacting with the environment using an exploratory method.

The present review also indicated that explorers are interested in exploring natural environments. Therefore, it is important to create a natural and non-linear space in the game design, and to develop the necessary tools and peripherals for explorers to practice their creativity and further explore the game environment. Information and location are also crucial in exploratory games. In designing these games, such measures as embedding open and raw content, using different methods for examining elements and the environment, and customizing and adding puzzles should also be considered in view of the learners' desire for independence. They tend to have access to all features of a game, and therefore game designers should highly value the freedom and independence of the learners. These results are consistent with the studies by Fortes Tondello (27), Heeter (29), Heeter et al. (18), Yee (32), Marczewski (41), Harteveld (53) that emphasize that the ability to customize and adhere to the principle of support independence and the promotion and representation of personal identity are very important to the explorers.

Another critical point to note in designing exploratory games is that explorer types are not interested in communicating with other players. Therefore, it is better not to include the components of cooperation for this type of player. This could be due to the inner motivations of explorers.

It was also concluded that storytelling is appropriate for the explorer player style. This result is consistent with research by Heeter (29), Heeter et al. (18), Yee (32), Hynninen (33), Kocadere (39), Dias & Martinho (43), ferro et al (19), Fortes Tondello (45) and the emphasis of some studies was on branched and character-oriented stories.

Another finding in this review was that aesthetics should be given importance in designing an exploratory game. These results are in line with research by Yee (32), Nacke (40), Monterrat et al (42), but no further details were provided in this regard.

The findings revealed that balancing a game for explorer players involves enhancing the challenge, making meaningful choices in the game, emphasizing the intellectual work (perception and analysis), designing long games, discarding punishment in the games, emphasizing players' freedom and designing more complex and detailed games. These findings are in agreement with research by Heeter et al. (18), Ferro et al (19), Fortes pirker (25), Tondello(27), Heeter (29), Darby (30), Bostan (31), Yee (32), Lindberg (36), Frye (37), Nacke (40), Marczewski (41) Dias & Martinho (43), Hanna (47), and Harteveld (53).

According to the results of this study, game design for exploratory style is different from other styles. For example, in designing a killer game style, emphasis is placed on competition among people, but the results here show that explorers are not interested in competing in the game. They mostly look for places to discover and satisfy their curiosity. The results of the present research show that, contrary to the achiever style, explorers do not seek to score points in a game. External motivations are not prominent in them, but they pursue their inner desire for knowledge and are attracted to the challenges and problems of the game. Also, unlike social types, explorers do not seek to collaborate and play in groups, rather, they like to make their own discoveries. Therefore, the components highlighted in this research and similar studies should be considered in designing explorer-style games. In this way, explorer types can further engage in educational games, and thereby both recreational and educational aspects are addressed.

Research Suggestions

In the present study, the components affecting the game design for explorers were introduced, but no model was presented for production stage. In future research, it is better to present a model and a product that is based on the provided components. Moreover, one can evaluate the impact of the developed game on a target group and compare the results for validation purposes. Also the components obtained in this research can be used and tested in future studies on

exploratory educational games. It is also suggested that researchers expand on the design components for other player styles.

Ethical Considerations

This research was conducted under the supervision of Allameh Tabataba'i University in Tehran, Iran.

Funding/support

No funding was provided for this work.

Conflict of interests

The author declares that they have no conflict of interests.

References

1 Dong T, Dontcheva M, Joseph D, Karahalios K, Newman M, Ackerman M. Discovery-based games for learning software. InProceedings of the SIGCHI conference on human factors in computing systems 2012 May 5 (pp. 2083-2086).
2 Sukartiningsih S, Sarmini S, Jacky MJTIJoSS. What is Discovery Learning Can Grow Critical Thinking Skills? 2019;2(2):87-94.
3 Johnson AP. Teaching strategies for all teachers: Enhancing the most significant variable: Rowman & Littlefield; 2017.
4 Dickey MD. Game design narrative for learning: Appropriating adventure game design narrative devices and techniques for the design of interactive learning environments. Educational Technology Research and Development. 2006 Jun 1;54(3):245-63.
5 Gee JPJAnls. Pleasure, learning, video games, and life: The projective stance. 2007;29:95.
6 Lee KM, Park N, Jin S-A. Narrative and Interactivity in Computer Games. 2006.
7 Neitzel BJHocgs. Narrativity in computer games. 2005:227-45.
8 Shaffer DW. How computer games help children learn: Macmillan; 2006.
9 Adams DM, Mayer RE, MacNamara A, Koenig A, Wainess RJJoep. Narrative games for learning: Testing the discovery and narrative hypotheses. 2012;104(1):235.
10 Kapp KM. The gamification of learning and instruction: game-based methods and strategies for training and education: John Wiley & Sons; 2012.
11 Bartle RJAO-Dhmpbe-jvbh. Hearts, Clubs, Diamonds, Spades: Players Who Suit MUDs in: Journal of MUD Research 1, 96. 1996.
12 Dörner R, Göbel S, Effelsberg W, Wiemeyer J. Serious Games: Springer; 2016.
13 Stieglitz S, Lattemann C, Robra-Bissantz S, Zarnekow R, Brockmann T. Gamification: Springer; 2017.
14 Kramarzewski A, Nucci ED. Practical Game Design: Packt Publishing; 2018.
15 Klawe M, editor Computer games, education and interfaces: The E-GEMS project. Graphics interface; 1999.
16 Bontchev B, Georgieva OJCiHB. Playing style recognition through an adaptive video game. 2018;82:136-47.
17 Bateman C, Boon R. 21st Century Game Design (Game Development Series): Charles River Media, Inc.; 2005.
18 Heeter C, Lee Y-H, Medler B, Magerko B, editors. Beyond player types: gaming achievement goal. Proceedings of the 2011 ACM SIGGRAPH Symposium on Video Games; 2011.
19 Ferro LS, Walz SP, Greuter S, editors. Towards personalised, gamified systems: an investigation into game design, personality and player typologies. Proceedings of The 9th Australasian Conference on Interactive Entertainment: Matters of Life and Death; 2013.
20 Konert J, Göbel S, Steinmetz R, editors. Modeling the player, learner and personality: Independency of the models of Bartle, Kolb and NEO-FFI (Big5) and the implications for game based learning. Proceedings of the 7th European Conference on Game Based Learning (ECGBL); 2013.
21 Alfieri L, Brooks PJ, Aldrich NJ,

Tenenbaum HRJJoep. Does discovery-based instruction enhance learning? 2011;103(1):1.
22 Mayer B, Harris C. Libraries got game: Aligned learning through modern board games: American Library Association; 2010.
23 Sangsawang TJP-S, Sciences B. Instructional design framework for educational media. 2015;176:65-80.
24 Isbister K, Flanagan M, Hash C, editors. Designing games for learning: insights from conversations with designers. Proceedings of the SIGCHI Conference on Human Factors in Computing Systems; 2010.
25 Pirker J, Gütl C, Löffler J, editors. PTD: Player type design to foster engaging and playful learning experiences. International Conference on Interactive Collaborative Learning; 2017: Springer.
26 Bontchev B, Vassileva D, Aleksieva-Petrova A, Petrov MJCiHB. Playing styles based on experiential learning theory. 2018;85:319-28.
27 Tondello GF, Wehbe RR, Diamond L, Busch M, Marczewski A, Nacke LE, editors. The gamification user types hexad scale. Proceedings of the 2016 annual symposium on computer-human interaction in play; 2016.
28 Monterrat B, Yessad A, Bouchet F, Lavoué E, Luengo V, editors. MAGAM: a multi-aspect generic adaptation model for learning environments. European Conference on Technology Enhanced Learning; 2017: Springer.
29 Heeter C, Fitzgerald JJMSU. Game Design and the Challenge-Avoiding Impression Manager Player Type. 2008.
30 Darby DG. Differentiation: A Taxonomy Of Online Learner Types In Higher Education: University Of North Texas; 2019.
31 Bostan BJCiE. Requirements analysis of presence: Insights from a RPG game. 2009;7(1):1-17.
32 Yee N. Motivations of play in MMORPGs. 2005.
33 Hynninen T. Identifying player profiles in video games. 2016.
34 Mena RJRJIJoG-BL. Player types, play styles, and play complexity: Updating the entertainment grid. 2012;2(2):75-89.
35 Xu YJTSToCSE, Journals iATSI. Effective gamification design: A literature review. 2015;3(4):47-54.
36 Lindberg RS, Hasanov A, Laine TH, editors. Improving Play and Learning Style Adaptation in a Programming Education Game. CSEDU (1); 2017.
37 Frye JM. Video game player profiles: bridging industry, game studies and social science perspectives: New York University; 2013.
38 Patterson J. Avian: Game design and player metrics for player modeling in educational games: Drexel University; 2014.
39 Kocadere SA, Çağlar ŞJJoET, Society. Gamification from player type perspective: A case study. 2018;21(3):12-22.
40 Nacke LE, Bateman C, Mandryk RL, editors. BrainHex: preliminary results from a neurobiological gamer typology survey. International conference on entertainment computing; 2011: Springer.
41 Marczewski AJCIPP, Charleston, Chapter User Types. Even Ninja Monkeys like to play. 2015:69-84.
42 Monterrat B, Desmarais M, Lavoué E, George S, editors. A player model for adaptive gamification in learning environments. International conference on artificial intelligence in education; 2015: Springer.
43 Dias R, Martinho C, editors. Adapting content presentation and control to player personality in videogames. Proceedings of the 8th International Conference on Advances in Computer Entertainment Technology; 2011.
44 Drachen A, Canossa A, Yannakakis GN, editors. Player modeling using self-organization in Tomb Raider: Underworld. 2009 IEEE symposium on computational

intelligence and games; 2009: IEEE.
45 Fortes Tondello G. Dynamic Personalization of Gameful Interactive Systems. 2019.
46 Rogers K, Kamm C, Weber M, editors. Towards player-centric adaptivity: Interactions of gameplay behaviour and player traits in a survival game. Proceedings of the 2016 Annual Symposium on Computer-Human Interaction in Play Companion Extended Abstracts; 2016.
47 Hanna N, Richards D, Hitchens M, Jacobson MJ, editors. Towards quantifying player's involvement in 3D games based-on player types. Proceedings of the 2014 Conference on Interactive Entertainment; 2014.
48 Kahn AS, Shen C, Lu L, Ratan RA, Coary S, Hou J, et al. The Trojan Player Typology: A cross-genre, cross-cultural, behaviorally validated scale of video game play motivations. 2015;49:354-61.
49 Savolainen M. Adapting game content with a player typology. 2019.
50 Quick J. Modeling gameplay enjoyment through feature preferences, goal orientations, usage, and gender: Arizona State University; 2013.
51 Khoshkangini R, Ontañón S, Marconi A, Zhu JJEP, GameOn. Dynamically extracting play style in educational games. 2018.
52 Fullerton T. Game design workshop: a playcentric approach to creating innovative games: CRC press; 2014.
53 Harteveld C, Sutherland SC, editors. Personalized gaming for motivating social and behavioral science participation. Proceedings of the 2017 ACM Workshop on Theory-Informed User Modeling for Tailoring and Personalizing Interfaces; 2017.