

Agile Development of Educational Games: A Hyper Casual Game Design Model Approach

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Hyper casual (HC) games are a sub-genre of mobile games. Such games are quick to learn, easy to play, require little attention and are played in short sessions. The development time of such games is agile, short and less costly. The development and revision of educational games takes a long time and is costly. The aim of this study is to examine the design processes of a company that develops HC games, to evaluate them from an educational game perspective and to reveal a game development model. Formative in-vivo naturalistic research method, one of the qualitative research methods, was used in the study. Data were collected through interviews. A Hyper Casual Game Design Model (HCGDM) is proposed based on insights from the game development experiences of the company. The HCGDM consists of core components, including the Team, Game Idea, Development Process, Publishing Process, and Optimization, which are carried out in sequential steps. Test, Target Audience, Stakeholders, and Corporate Culture also play a role with the core components in the development process and are related to how each step of development should be approached. It is thought that educational games can be developed faster by considering the model components.

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Introduction

Game

Playing games is an activity that arouses curiosity, fun and excitement. With technological developments, games have become more accessible. Today, many digital games have replaced traditional games. The history of digital games started in 1962 with "Spacewar!" and has continued with the release of new games every day (Rokošný, 2018). People of all ages and genders from different socio-economic backgrounds can play games on various platforms such as consoles, computers and mobile devices.

Digital games are software with specific rules and mechanisms and are played in virtual worlds (Ramadan & Widayani, 2013). Advances in computer graphics, artificial intelligence, human-computer interaction, security, distributed programming, simulation and software engineering have made it possible to develop games on a larger scale (Tap, Zin, Sarim, & Diah, 2021).

Mobile Games

It is possible to classify digital games based on the platforms on which the games are played. These are console games, computer games, virtual reality games and mobile games. Each platform has unique functions and features. Mobile devices are one of the platforms that make digital games portable and accessible at any time. For this reason, mobile games have recently become one of the most preferred game types.

Although mobile games have developed rapidly in recent years, the first game played on a mobile phone was introduced in 1994. This game was Tetris, which came pre-installed on the Hagenuk MT-2000 mobile phone (Microsoft, 2013). "Snake", which came pre-installed on Nokia cell phones, is also known as one of the most popular early mobile games.

The emergence of Web 2.0 and the ability to play games on social media platforms are important milestones in the popularization of mobile games (So, Seow, & Looi, 2009). In addition, the introduction of mobile devices with powerful hardware has also enabled mobile games to reach a larger number of users.

The increasing ease of access to mobile devices has led to an increase in the number of mobile game players. According to Statista, which provides statistics on market and consumer data, there are more than 1.5 billion mobile game players worldwide and the market size is over 121 billion dollars (Clement, 2023).

Hyper Casual Games

The increasing functionality of smartphones has made the use of these devices widespread and has led to changes in users' habits of using mobile phones. Nowadays, smartphones are indispensable devices that are always at hand. In this context, the use of mobile phones for entertainment purposes during free time or breaks has become a frequent behavior pattern. This behavior pattern has attracted the attention of developers and has been an important factor in the emergence of the Hyper Casual (HC) game genre (Knezovic, 2021). HC games are easy to play, quickly learned, require little attention and are usually played in short sessions. Since such games aim to satisfy the player in the short term, the skill curve is usually kept low (Järvilä, 2021). These types of games are typically played on mobile platforms such as cell phones and tablets.

A study showed that HC games are favoured for reasons such as reducing stress, killing time, experiencing the completion of a challenging task and competing with friends for points (Statista, 2020). Another study shows that HC games are 10 times more preferred than other types of mobile games (Knezovic, 2021). The fact that HC games are frequently used in daily life and are preferred at a higher rate compared to other game types has brought the evaluation of these games within the framework of educational games to the spotlight.

Educational Games

Garris, Ahlers, and Driskell (2002) emphasized that game features can be used to achieve educational goals and game elements should be activated in the teaching process. Gee (2004) stated that games with features such as communication and exploration through a community can be considered educational. These games include engaging, anxiety-reducing and inquiry-based activities; they also create active learning environments by guiding the user in the learning process (Tüzün, 2006; Bayırtepe & Tüzün, 2007; Vanbecelaere et al. 2020; Zeng et al. 2020). With a general framework, it can be said that educational games are both educational and entertaining computer software (Zeng, Parks, & Shank, 2020).

Research has shown that educational games support both individual and social learning. For example, in a study conducted by Tüzün (2006), it was found that in learning environments where educational computer games were used, students experienced a fun learning session and engaged in inquiry-based learning (Tüzün, 2006). Studies have also shown that educational games are not only educational and entertaining, but also increase students' motivation (Malone & Lepper, 1987; Tüzün, 2006; Bakar, Tüzün, & Çağiltay, 2008). Motivation researchers emphasize that motivating learning environments include elements of effort, curiosity, fantasy, and control, and that games can represent such environments (Rieber, 1996).

It is seen that educational games that support fun and social learning help to achieve certain educational goals when they are used together with the motivation they provide. In learning environments where these elements are active, learners have positive motivation and experience a flow experience while performing tasks with their own knowledge and skills (Akgün et al., 2011). According to Akgün et al. (2011), students are usually not aware of their progress during this period.

There are also some criticisms and negative views about educational games. Kirriemuir and McFarlane (2004) argue that educational games can overly absorb students, leading them to ignore or neglect other valuable course-related activities. In addition, Kirriemuir and McFarlane state that they are uncertain whether the time allocated to games can be used for more educationally valuable activities. Demirbilek and Koç (2019) stated that educational games can cause problems in classroom management. Some faculty members who participated in Demirbilek and Koç's study emphasized that games can cause classroom management problems and students can become addicted to games. Drugaş and Ciordaş (2017), who conducted research on the perspectives of parents, gamers and psychologists on games, stated that students who are inexperienced in playing games may exhibit negative attitudes towards activities related to educational games. However, psychologists who participated in Drugaş and Ciordaş's study expressed concern about the negative situations that students may encounter when left unsupervised in the virtual worlds.

Educational Game Design

Educational games can be used to achieve desired educational outcomes. In this framework, a game must have certain qualities in order to be educationally functional. The process of designing an educational game is called "educational game design". Educational game design involves making the game suitable for the objectives of the course and planning the experiences of the students while playing the game (Akgün et al., 2011). According to Akgün et al. (2011), different educational game design models have been developed as a result of the differentiation of factors such as educational environments, educational objectives and target audience. For example, the 'Level Up' model focuses on the development of new design and evaluation methods for educational games (Eagle, 2009). The 'Framework for The Analysis and Design of Educational Games' model examines how game dynamics, mechanics and aesthetics can be integrated for educational purposes (Aleven, Myers, Easterday, & Ogan, 2010). The 'Adaptive Digital Game-Based Learning Framework' is a more general approach that builds on existing models and frameworks to design student-centered, game-based learning environments (Tan, Ling, & Ting, 2007). It is possible to give more examples of game design models.

Developments in game technology, diversification of game platforms and changes in educational paradigms require the development of new game design models. Evolving factors indicate that studies should be conducted on improving existing educational game design models and developing new models.

Purpose and Importance

Educational game design models in the literature define the procedures required for the development of an educational game. These procedures and the experiences obtained from the use of games in educational environments show that the development time of educational games is long (Tüzün, 2007; Tüzün, Akıncı, Yıldırım, & Sırakaya, 2013). According to Tüzün (2007), the long development and update times may undermine the acceptance of these games among teachers, students, administrators and parents. In addition, long development and update times may be an obstacle to the integration of rich technology applications in schools in curriculum-intensive educational systems. Lastly, a long development and update time may reduce learners' interest in educational games and lead to frustration and disappointment. These situations may negatively affect the contribution of educational games to the learning experience. For these reasons, shortening the development and updating times of educational games may ensure that these tools can be used more effectively in education. In different studies, developers, trainers and practitioners emphasize that the development and update processes of educational games should be completed in a much shorter time (Tüzün, 2007; Tüzün et al., 2013; El-Masri & Tarhini, 2015; Callaghan, Savin-Baden, McShane, & Eguiluz, 2015).

In terms of development processes, it is seen that the design processes of HC games are faster and more dynamic compared to other game genres. Therefore, it is thought that the experiences gained from the design processes of HC games may be useful in shortening the development and update times of educational games and may provide some practical benefits in the development of these games.

In this framework, the aim of this study is to examine the game design processes of a commercial company that develops HC games. In addition, the aim is to evaluate this information from the perspective of educational game development. It is thought that these

experiences can be guiding in shortening the development time of educational games, updating existing educational game design models, leading the emergence of new educational game design models, and bringing a new perspective to the development processes of educational games. There are potential benefits in addressing the design processes of HC games in an educational context. For this reason, the following research questions was sought to be answered:

Problem: How should the design processes of HC games be handled in the context of educational games?

RQ 1: What are the components of the HC game design process?

RQ 2: How should the components of the HC game design process be brought together within a model framework?

Method

Research Design

In this study, qualitative research method is used to explore the design process of a company focused on designing and producing HC games. Qualitative research is an approach that emphasizes the importance of the context in which social phenomena are studied. Merriam (2018) states that events can best be understood within their own settings and that findings should not be interpreted independently of the setting in the evaluation of events. In this study, the formative research method was used to present designs, theories, models and practices to elaborate the game design process (Reigeluth & Frick, 1999). Formative research also includes sub-research methods. In this study, the natural flow of the game design process was examined. Therefore, in-vivo naturalistic formative research method, which is a sub-method of formative research, was used. The in-vivo naturalistic formative research method includes steps such as determining the design situation, collecting and analyzing formative data, and proposing a theory or model (Reigeluth & Frick, 1999).

Participants

The data for this research were collected from a commercial game development company located in the Technopark of a university in Turkey. The company was founded by three partners, one of whom holds a bachelor's degree in textile engineering and one in statistics. The other partner is an undergraduate student in archaeology. The company actively follows developments in the gaming industry by participating in conferences, panels and events both domestically and internationally. The Company focuses on developing mobile games in the HC genre. A car racing game developed by the company in the HC category managed to reach 20 million users within three months. Thanks to this success, the game reached the second position in the IOS and Android app stores in the United States. In addition, the game ranked in the top three of the most played games in the car racing game category in 165 different countries.

The interview was conducted with two participants at the same time. One of the participants is a manager and the other is a senior developer. Information about the participants is given in Table 1.

Table 1. Details of participants

Code Name	Sex	Title
K1	Male	Manager
K2	Male	Senior Developer

Data Collection Tool

A semi-structured interview form was used as a data collection tool. In the semi-structured interview approach, the interviewer asks questions based on pre-prepared questions and can also collect data by asking additional questions to gather detailed information when necessary. This method was developed to ensure that all dimensions of the research questions are addressed, and the order of the questions is not important (Yıldırım & Şimşek, 2013).

The interview form was prepared through a literature review using keywords such as "game design", "game design processes", "educational game design", "educational game design models" and "educational game design process". As a result of the literature review, the studies that were thought to contribute to the research were read and analyzed. Based on these analyzes, interview questions were developed. During the development of the interview questions, a field expert was also consulted. The interview questions were finalized in line with the feedback from the expert.

Data Collection

Study was conducted by three researchers and one faculty member. The researchers are doctoral students. The researchers and the faculty member did not have any previous experience shared with the participants. The faculty member has conducted many studies on "Educational Game Design" and contributed to this study as a field expert. The researchers took an "Educational Game Design" course as part of their doctoral education.

In the data collection phase, interview method was used as a data collection tool in order to reveal the meaning. The interview was conducted via Whereby video conferencing service. Before the interview, the details of the research were shared with the participants. The necessary permissions were obtained for the names of the company and the participants to be included in the research and for the interview to be recorded. The interview took approximately 90 minutes and probe questions were asked in addition to the prepared questions.

Analysis of Data

The data were obtained from the interview and transcribed using the sonix.ai service. These transcripts were coded separately by three different researchers. In order to ensure consistency, the codes produced by each researcher were reviewed by the other researchers and the final codes were generated. The codes were grouped under themes and expert opinion was sought on the appropriateness of the themes. Based on the data obtained from the interviews, the researchers individually expressed the relationships between the themes and proposed models showing these relationships. Each researcher reviewed the proposed relationship models and shared feedback with the other researchers. After the relationships between the themes were determined with the consensus of the three researchers, the model presented in Figure 1 was formulated. The explanations of the themes in the model were explained with the data obtained from the interviews.

Trustworthiness

Trustworthiness are important phases that need to be considered during the conceptualization, data collection, analysis, interpretation, and presentation of findings of any research, regardless of its type (Merriam, 2018). The validity and reliability dimensions of this study were explained according to the strategies put forward by Guba and Lincoln (1981) for validity and reliability studies in qualitative research. Data collection and analysis processes were conducted by three researchers to ensure researcher triangulation. The data were also shared with a subject matter expert and corrections were made based on expert feedback. In-depth interviews were conducted with the participants via e-mail about the points that were unclear or not clear enough during the data analysis. The roles of the subject matter expert and the researchers in the study process were clearly stated. To ensure transferability, participants were selected from those who could provide data to the study within the framework of the research questions. Quotations from participant statements were used to elaborate the relationships presented in the model. To ensure consistency, the coding of the data and the control of the results were carried out individually by the researchers. The transformation of codes into themes was carried out separately by the researchers. The final themes were created after the control and approval of the subject matter expert. Interviews were recorded and stored. Processes based on data collection and analysis were clearly stated.

Findings

As a result of the data analysis, 10 themes and 37 codes emerged. The theme with the most sub-codes was "Development Process" and the theme with the least codes was "Target Audience". The emerging themes and codes are shown in Table 2.

Table 2. Themes and Codes

Themes	Codes
Team	Core team
	Team
	Team training
	Desired characteristics in the team
	Roles of team members
	Process of interns joining the team
	Information flow and collaboration within the team
Hyper Casual Design/Type	Hyper Casual
	Difference between Hyper Casual and computer games
Corporate Culture	Research and development (R&D)
	Corporate culture
	Know-how
Game Idea	Sharing with the team
	Game idea
	Exclusivity
	Contact with life
Stakeholders	Investor expectations
	Stakeholders
	Relations with the publisher
Development Process	Game objectives

	Effect of office layout Development process Time planning Documentation Reporting Game development Assets Software used
Target Audience	Target audience
Publishing Process	Publishing process Advertising
Optimization	Quality Enhancement Improvements Effectiveness
Test	Test Quality control criteria Feedback

In line with the information obtained from the themes and codes, the research questions were answered separately. In this section of the study, the answers to the research questions are presented.

The first research question of this study was "What are the components of the HC game design process?" After coding the transcripts of the interviews with the participants and consolidating the codes under themes, the components of the HC game design process were identified as: team, game idea, development process, publishing process, optimization, testing, target audience, stakeholders, and organizational culture. The details of these components are presented in the following section.

Team

As with other video games, HC games are developed by professional teams including developers, testers and graphic designers. When hiring new employees, company managers make sure that new employees are creative personalities who enjoy playing games. They also stated that it is important for new employees to be individuals who can seamlessly integrate into the existing team synergy:

K1: When we were building a game development team, we actually looked at how we could capture this synergy [between the team], this internal dynamic. First of all, it was a team that was creative, loved to play games and had the ability to see games as an application.

The short duration of the HC game development process, from testing to publication, requires being practical. Participants stated that they achieved this practicality with a core team. Although the number of people in the team varies, there is a fixed core team:

K1: [The core team] consists of four people, but when we combine with all our partners, it can be over 10 people. When we try to do a workshop, we can have up to 15 people. Or we

have more than 30 people in our channel [communication channels in a closed software used for communication purposes].

The participants stated that due to the dynamics of the HC game development process, the role definitions of team members can change depending on the situation and circumstances. They also mentioned that this phenomenon can sometimes cause difficulties for the organization:

K1: Even though everyone specializes in their own field, there is an organization problem, especially when you try to do a big job with a small team. [...] But when we were in a small company and building this team, we thought that we should increase the knowledge of the team members in order not to fall into a handicap in this regard as much as possible. In other words, the 3D artist in our team can also do algorithm development, coding at the same time, even at a basic level. [...] We have a concept like a completist. [Someone who is a completist] is capable of performing all operations from the game model to the delivery of the animation. When we identify bottlenecks [when starting a new project] and intervene in them, the roles of the people in the team become more or less clear.

Participants focused on creating a culture where employees get to know each other and adopt the company's philosophy. To achieve this goal, they stated that an orientation program is organized for each new employee, outlining the company's past projects and important milestones. They believe that a new member of the team can contribute through these orientations:

K1: It is not possible for a new employee to contribute to a project without knowing the company culture and speaking the same jargon as existing employees. For this reason, we put the newcomers into our orientation program and show them from which stage we started, which games we coded and how we coded them. [...] We tell our new employees what we are aiming for as a company, what kind of growth target we have and what our expectations are from them. This is how our orientation process goes.

Participant K1 also stated that they also benefit from overseas training opportunities for the training and certification of team members:

K1: We prefer overseas online education programs in all our trainings. We especially ask our employees to complete the trainings on game development given by Michigan State and University of Colorado on the Coursera platform and receive certificates.

Game Idea

The game idea is the beginning of the game design process. Participants stated that they contributed to idea generation by exchanging ideas at this stage and engaging in activities that pushed the limits of the mind with the synergy they created within the team. It was also emphasized that only a small part of game development is coding, and the most important and difficult part is generating ideas:

K1: We spend more than 9 hours a day in front of the computer, and only 20% of that time is spent writing code. But being inspired by what you see on the screen is not enough to generate ideas and boost creativity. The important thing is to come up with an original idea. We think it's about getting involved in life. For this, we make on-site observations, we share what we see with each other during the meetings we hold. In this way, we collect the possible game ideas we can think of in a pool. I can briefly summarize this process as

follows: making observations from daily life, questioning what can be done with what we have obtained from observations, clarifying a game idea as a result of a short research-development (R&D) study, [...] obtaining an output.

During the game idea generation phase, the participants stated that they constantly play new games to follow what their competitors are doing, to monitor developments in the game industry, and to determine whether a game idea has been realized before. They also emphasized that they always include company-specific motifs and approaches in a game idea:

K1: Everyone in the team downloads and plays HC games they like. This way, we can test the games developed by our competitors and also get a glimpse of the game ideas out there. Thanks to these tests, we have a general idea of what every HC game ever made is and we can come up with different game ideas. [...] It was a game that had not been done before and had traces from life [most downloaded game]. This is where the importance of our approach of incorporating things from life into the game emerged.

The participants stated that the ideas that touch the real life are a vital element for them in the process of generating game ideas. They also attributed the success of the car racing game developed by the company, which has been downloaded more than 32 million times worldwide, to the fact that the game idea was inspired from real life:

K1: Users have an expectation when they download a game or see an advertisement for a game, and we think it is important at this point that the game can touch life. In our opinion, the feeling obtained from the experience of playing a game that cannot touch life will not satisfy the user. As a result, that game will be just an application downloaded to the cell phone. [...] That's why we chose the slogan "tap the life" when we founded the company. This is our motto. For this, it is necessary to capture the projection from life. If we can't achieve this, it doesn't matter whether we can write good code or create good animations. Because the feeling will not pass to the user. There will always be a synthetic and artificial situation. Considering that playing games is a voluntary activity, the importance of this approach becomes clearer.

Development Process

The development process is the stage where the game idea starts to be realized. Participants emphasized the importance of a fast development process in the HC game industry and underlined the need for knowledge and practical experience to achieve this. It was also mentioned by the participants that the creation of numerous prototypes is an effective tool for gaining knowledge and experience:

K2: When we decide on a game idea, we can produce a demo of it running on a cell phone on the same day. The main reason why we can achieve this is the work we have done before. When developing an application, there is a part of it that meets the minimum requirement. This part is called prototype in the game world. [...] because HC games are basically an iteration of these prototypes.

The HC game development process consists of many sub-components. The interview transcripts revealed that the key components of this process are "game objectives", "impact of office layout", "time planning", "documentation", "asset generation" and "software used in the

development process". In addition, variables such as "target metrics", "cost", "play times" and "continuation times" were also identified as factors that can affect the development process.

According to the participants, office layout plays a crucial role in establishing effective communication in the development process. This can lead to more efficient progress. They also emphasized the importance of using suitable equipment as it can help to save time in the development process:

K1: We are not a company that has adapted to remote working. We are a company that gets our strength from working elbow to elbow. The layout of our desks, being able to see each other's screens, and the fact that there are four of us and we use six chairs. Why do we do this? For example, so that one of them can go directly to the other quickly, not by driving the chair. [...] We even choose the monitors carefully so that we can see each other more easily. Therefore, we organize an office where people working together on the same project can have very close contact with each other in the office, and even understand what stage they are at when they see the screen without even asking questions, so that we don't waste a lot of time in meetings.

According to the participants, the fast-paced nature of the HC gaming market requires the development of as many games as possible in a short timeframe. To adapt to this dynamic, participants described their approach to time planning as follows:

K1: The products we produce have to be on the market in a very short time. Our goal is to complete the main mechanics of the game in three days, to make artworks suitable for the target audience in two days and to finish the whole production process in five days. [...] In other words, what should we sacrifice and what should we spend more time on?

According to the participants, documentation is an important element of the development process as it provides knowledge and experience. Although the participants acknowledged the value of documentation, they also stated that sometimes they do not create documentation because it is time consuming. They also stated that the type of documentation used in HC games is different compared to the development processes of other game genres due to the necessity of fast game development. In summary, it was emphasized that the primary purpose of documentation in HC game development is to produce informative documents that can help address potential future issues:

K1: Our teammate who first comes up with the idea for the play prepares a rough text. What kind of models do we need? What will be the strategy for building these models? He passes this to another employee for 3D modeling. From there it comes to the game designer. The game designer adds rough details about the game such as the map of the game will be like this, there will be enemies here, etc. to the text, and makes drawings if necessary. After this stage, the coding phase of the game begins. Until this stage, the information that will be communicated to the developers by other employees is added to the game document. [...] So we usually have such short simple documents in HC game development. We are actually making documentation by taking a more general approach, not specific to a game. To record our entire production process and to maintain our company culture. [...] We develop tools specific to our own company, for example, we have documents on this. Our aim is to handle documentation processes without getting bogged down in bureaucracy. In fact, in the natural flow of the game development process, it's just so that we don't forget

anything we've done and don't waste time on activities that have no added value. We are concerned so that our knowledge can continue for years.

Participants emphasized the benefits of having a comprehensive library of assets for game development. It was also mentioned that such resources significantly speed up the game development process. It was stated by the participants that the company has a comprehensive asset library and approximately 90% of the assets in the library are produced by the company. It was also noted that the attributes of the assets may change according to trends in the gaming industry.

Using the proper development environment plays a very crucial role in the game development process. The participants stated that they use the following softwares: Unity, Visual Studio, Photoshop, Illustrator, Blender, Maya, 3DMax, EPni and Sensor Tower.

Publishing Process

Participants stated that there are various testing phases in the game publishing process. In addition, partnerships are also established with other companies operating in the field of promotion and publishing:

K2: We have a partnership with them [publishers] for about a year. In the process of publishing a game, if the game has passed the tests, the only thing to do is to spend money to promote the game.

Before publishing a game prototype, it undergoes CPI (cost per install) testing to assess its suitability for the target audience and cost-effectiveness. Various social media campaigns and advertisements are also prepared to promote the prototype. Participants reported that they receive feedback from publishers based on data from users about which ads attract more attention. After the necessary modifications are made according to this feedback, the publishing phase begins.

K1: When a prototype is produced, tests determine whether it will go to the user or not. Creatives [promotional materials and advertisements] are being prepared for the tests. [...] These ads have a winning bid [money spent for the best result based on cost] value. This value tells us which ad attracts more attention. [...] Facebook also provides us with a lot of information about the ad, such as how many people clicked on the ad, how many people went to the app store and downloaded the game or not. The data about the ads coming from all these different channels is instantly reflected on our publishers' and our control panel. The metrics coming from here affect the course of the prototype. We make changes to the prototype according to the incoming metrics. We call these iterations. We organize new advertising campaigns specific to each iteration and track their metrics. If there is an iteration whose metrics are at the desired level, we focus on this iteration. [...] At this stage, we sometimes work on more than 400 ads together with our publishing partner.

Optimization

According to participants, visual elements are the primary focus in the quality control process. This emphasis on visual elements is also extended to the development phase, where visual assets are produced specific to the target audience. At this stage, the selected visuals are carefully integrated with the internal dynamics of the game to create a harmonized final product. This shows that visual elements are a key factor in the quality control process:

K2: In test videos [videos made for ads], the first thing that attracts the user is the visuals. 70% of the users come or don't come [by liking] the visual. That's why our primary target is visuals in quality control. Definitely visual. Then the harmony of the visuals with the internal dynamics of the game.

According to the participants, optimization is an important issue that needs to be addressed. Participants underlined that well-optimized games have a better chance of success:

K2: If the visuals are in harmony with the dynamics of the game and the game has been successful in the tests, it's time for optimization. Because an application that works properly on IOS may not work on Android. We had very big optimization problems in this regard.

K1: When we look at the statistics of Android devices that crash, we see that it is a very small part of our portfolio. But despite this, we don't want to give our users a bad experience. That's why we have to make some changes in the game's code. [...] While trying to improve the user experience, the functioning of the game can be disrupted. For this reason, optimization is a very difficult and complex situation.

Test

It is stated that design and testing processes should be intertwined for the success of a project. Participants emphasized the importance of iterative testing in determining and highlighting the most effective game features. Participants described their own testing process and its importance for the overall success of the project as follows:

K2: In our initial testing process, CPI [Cost Per Install] value is prioritized. Did the mechanics and visuals attract people? How is retention [the value of how many days players keep the game on the phone]? [...] The retention value is expected to be above 40% for the first day. If the retention value is above 40%, we look at the play time value. If the play time value is above 3 minutes, that is, if each user plays more than 3 minutes, that game is considered to be successful in the third stage. Then we start the fourth stage checks. This stage includes tests with ads. [...] In the version of the game with ads, if the retention value is still above 25%, we consider the fourth stage a success. Finally, we start the fifth stage checks. This is the hard ad [maximum ad exposure] stage. [...] At the end of this process, if the retention value is still above 20%, we consider the game project a success. We finalize the development process.

Testing processes are activities carried out to correct problems in the game. Participants pointed out the importance of partners' feedback in this process:

K2: Our partners give us feedback. For example, change the assets, change the colors or other more specific changes. Our partners think that these changes will be more effective according to the measurements they have obtained. So we make these changes and run the tests.

Target Audience

As participants noted, market share is an important factor in the HC game category. Furthermore, the participants indicated that the primary target audience for their games is users in the US, due to the higher number of gamers using devices with IOS operating systems in the US and the significant amount of advertising revenue in US dollars. This suggests that geographical and economic factors can influence audience selection in the HC gaming industry:

K2: The first target for all HC category games is the American market for iOS devices. Because the percentage of iOS device users in America is quite large. As a result, regardless of age and gender, we try to appeal to the audience there first. Even after our game ranks first in the charts, our primary target audience is still the United States. Since all revenues in the US are in dollars and most of the ad networks [advertisers] are located in the US, we get the biggest market share from there. Therefore, our primary target is America, then other countries.

Stakeholders

The company needs to collaborate with various stakeholders to successfully promote, advertise and publish HC games. These stakeholders were actively involved in the game design process and their feedback was highly valued:

K1: [...] how we would follow trends and how we would market the games came up. At this stage, digital marketing and game publishing skills gain importance. Will we do these within the company? Will we cooperate with other partners? Through which channels can we realize these? [...] At this stage, we had some meetings with various publishers for cooperation. Apart from that, we are already in close contact with various gaming associations and platforms.

Corporate Culture

Participants defined "corporate culture" as the built-in infrastructure and unique language within a company. They emphasized the importance of team meetings, research and development (R&D) meetings and idea exchanges in developing and sustaining this culture:

K1: Especially when developing a game, there are some parts that are common to every game, especially if there has been experience in this area before. At least a software hierarchy, 3D modeling, folderization of files, etc. So the company has its own language. We create and save this language once.

The participants emphasized that the creation of an infrastructure for game development serves as a foundation for the creation of other components of the game:

K1: After developing many games, we have accumulated a certain know-how. For example, which colors attract the user more. [...] After acquiring know-how like these, what we really focus on is only the mechanics of the game. Once we find a game mechanic, we quickly put other elements in place.

Hyper Casual Game Design Model (HCGDM)

In this study, the second research question aims to investigate the integration of various components within the design process of a HC game within a model framework. The components considered include team, game idea, development process, publishing process, optimization, testing, target audience, stakeholders and corporate culture which were identified based on the game company's experiences in developing HC games. To integrate these components within a model framework, an examination was conducted to uncover the relationships between them. As a result, a Hyper Casual Game Design Model (HCGDM) was proposed, in which the components of team, game idea, development process, publishing process and optimization form the general flow of the development process, while the components of testing, target audience, stakeholders and corporate culture allow for

customization of the general flow according to changing conditions. The model illustrating the relationships between the components is depicted in Figure 1.

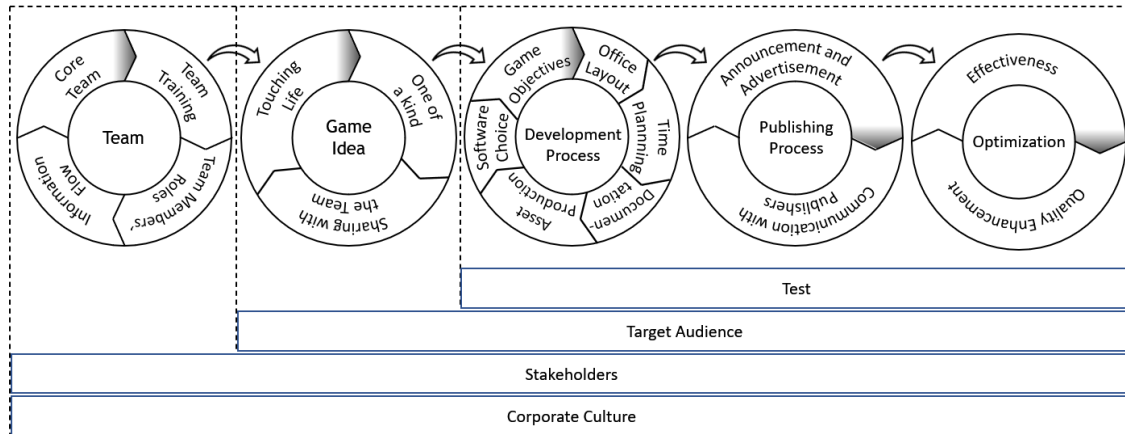


Figure 1. Hyper Casual Game Design Model (HCGDM)

In the HCGDM, team, game idea, development process, publishing process and optimization components constitute the core components of any HC game development project. These core components should be seen as successive steps in the development process. As shown in the visual representation of the model, several variables specific to each step can influence the progression of the steps. In the visual representation of the model, the variables that should be considered initially in each step are indicated.

In addition to core components, test, target audience, stakeholders and corporate culture processes also play a role in the development process. These are related to how each development step should be handled. It is possible for a development step to be related to more than one process. The components related to both development steps and development processes will be examined in more detail in the following sections of the study.

Test

In the model, the testing phase starts with the development process. Testing continues throughout the "development process", "publishing process" and " optimization" steps. The HCGDM posits that tests are conducted during the "development," "publishing," and " optimization" processes and are tailored based on the data obtained from users. This approach shows that the testing process is user-oriented and dynamic, as supported by the participants' statements. During the optimization phase, tests are conducted to ensure that the game meets a certain standard on all devices.

Target Audience

In the model, the target audience is taken into consideration starting from the game idea phase. The idea for the game should be original, authentic, and based on real-life experiences that can appeal to the target audience. Because a game that does not address the target audience will most likely not be of interest to users.

Participants emphasized the importance of considering how the end user will feel when conceptualizing the game idea. Therefore, the target audience also plays a role in choosing game mechanics and creating assets. However, the target audience is also an important factor in the publishing process, as reaching the right audience is critical to the success of the game.

It is important for the game to be appreciated by the correct target audience and to make improvements that suit their needs. Additionally, optimizations specific to the devices used by the target audience can enhance the sustainability of the game.

Stakeholders

In the HCGDM, stakeholders are involved at all stages from team to optimization. For example, technoparks and large game production companies offer internship programs and incubation centers to support the formation of teams in game companies. In addition, stakeholders often provide consultancy services during the maturation phase of game ideas. Stakeholders also play a role in the development process by providing feedback and guidance.

The role of stakeholders in the HCGDM is particularly prominent in the game publishing process. Stakeholders contribute significantly to the delivery of the game to users through their advertising services and infrastructure.

Stakeholders can also contribute to the optimization phase by providing guidance. For example, publishers share their data with the development team to help detect defects in the game. In addition, feedback from real players is also passed on to the development team through these publishers. This demonstrates the important role stakeholders play in ensuring the optimization of the game.

Corporate Culture

The functioning, perspective and goals of the organization affect the entire game development process. Training and development of employees through internship programs and incubation centers is an important part of the corporate culture. This training, which covers a wide range from internship to team membership, is an integral part of the success of the game development process.

In HC game design, the interests of the target audience are a very important factor in finding game ideas. Therefore, it is very important for game companies to understand the interests of their target audience when generating game ideas. Game companies often try to benefit from trends and create game ideas that will address the users.

Organizational culture also plays an important role in shortening production time and meeting standards in the development process. In this context, thanks to the accumulation of know-how, games with all aspects, from game mechanics to assets, are produced quickly without missing the current trends.

The facilitating effect of corporate culture on the publishing process contributes to the acceleration of the publishing process through the trust established through the common language and cooperation with publishers. This enables the product to be delivered more effectively to the target audience and facilitates the collection of objective feedback. This positively impacts optimization and plays an important role in addressing user concerns and increasing the penetration of the product.

Conclusion, Discussion and Recommendations

HC games, as stated by Yang and Sun (2020), emerged as a result of a specific need and are a type of game with unique characteristics. These games are characterized by a single game

concept, a small number of game mechanisms, a small development team, low development costs, and unique marketing processes. Educational games, on the other hand, are a type of game in which users are engaged in active exploration, practice, and learning, often without being aware of it (Zeng et al., 2020). In order to provide such a learning experience, various educational game development models have been proposed in the literature. The evolution of game playing culture, new game dynamics, changing user expectations, and the emergence of new game platforms have led to the development of new game design models.

It is thought that examining the HC game approach in the context of educational games can lead to a new approach in educational game development. The main bases of this view are the accessibility, simplicity, relevance to daily life and usability on smart devices, as well as low development costs and short development times of HC games.

This study was conducted with the idea that the experiences gained from the development of HC games can be used in the development of educational games or integrated into existing educational game design models. The experiences of a commercial company developing HC games were analyzed. As a result of the analysis of the development processes, the themes of team, corporate culture, game idea, stakeholders, development process, target audience, publishing process, optimization and test emerged. A Hyper Casual Game Development Model (HCGDM) is presented by trying to reveal the interactions and relationships between these themes. HCGDM is a game development model that addresses all processes from A to Z in developing a game in the HC genre. In the literature, it is emphasized that the game development model should clearly address the entire development process in order to develop effective educational games (Linehan, Kirman, Lawson, & Chan, 2011). It is thought that the HCGDM is also appropriate to be used as an educational game development model and offers some innovations that serve this purpose. In order to better understand the contributions of the model to educational game development, it is possible to discuss the results obtained under two main categories in terms of technical and pedagogical aspects.

From a technical perspective, the model emphasizes a small team structure, highlights optimization processes, includes alpha and beta testing processes, and proposes an asset library mechanism. These technological aspects of the model allow for rapid organization, agile game development, quick response to stakeholder feedback, faster response to the needs of different learner groups, increased diversity, cost and time savings, and the ability to address a wider target audience. Fifteen different educational game development models have been examined in different studies conducted by different researchers such as Tahir and Wang (2019) and Akgün et al. (2011). In none of the models examined, aspects related to the game development team, optimization and improvement, asset library, alpha and beta testing processes were not addressed. In terms of the existing models in the literature, HCGDM has contributed to the literature by offering a new perspective on educational game models.

Among the many pedagogical implications of the model, the concept of designing games based on outcome-based learning objectives is particularly noteworthy. This approach is in line with the nature of HC games and guides the design of separate and rapid games for each educational outcome. The research by Serrano-Laguna et al. (2018) also supports this approach, emphasizing that games designed specifically for learning goals help users achieve specific learning goals and that games of this type are effective in supporting the learning experience

and focusing on learning goals. In this context, HCGDM, in line with the literature, offers game design strategies that will enable educational outcomes to be achieved quickly and effectively.

The model's focus on rapid game development may help to address concerns that are often emphasized in the literature about the use of games in educational settings. In particular, as noted by Tüzün et al. (2013), long development and update times can reduce students' interest in educational games, leading to frustration and disappointment. By eliminating such problems, HCGDM can increase stakeholders' motivation for education and make a significant contribution to the literature.

The proposed model emphasizes the rapid prototyping and testing processes of games and these features enable multiple iterations of a game. This provides the basis for a continuous improvement approach, allowing a game to be continuously improved in line with the data obtained from learning processes and student feedback. As a result, it is possible to achieve learning objectives more effectively. In line with the results obtained from the study, Win and Heeter (2006) also reached similar results in their study on iterative game testing processes. They stated that iterative testing processes, especially those used by commercial companies, can be particularly important in resolving conflicts between pedagogy, game and content.

HCDGM recommends involving the target audience in the development of the game through rapid prototyping and multiple iterations. Involving students in the development of the game can be considered as another way for them to contribute to the learning process. In a study by Zin and Yue (2009) on the role of games in making the learning process effective and attractive, this issue was emphasized and it was stated that this approach would enrich students' learning experiences and allow them to achieve learning goals more effectively. These results obtained from the study are consistent with the literature.

Limitations

The limitation of this study is related to the sample used. The research relies on information gathered from a commercial game development company during the data collection process, and in particular the opinions of the two main participants (a manager and a senior developer) working in the company.

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