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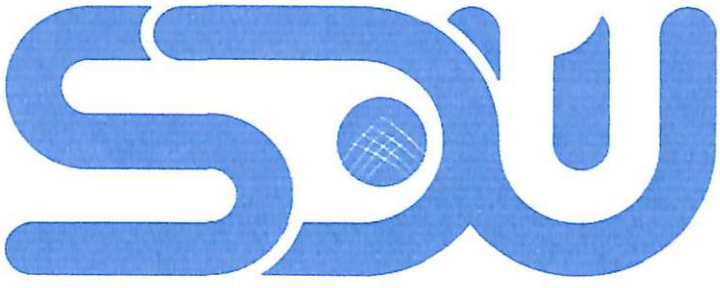

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Gamification as an Educational Technology Tool in Motivating and Engaging Students in Process of E-learning

THESIS

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Abstract

COVID-19 proved that our training programs were not ready to switch to a full-fledged online format. At the same time, as is known, students had a reduced sense of motivation and involvement in the process of distance learning. World scientists propose the integration of gamification mechanics as one of the solutions to this urgent problem. However, not all of the proposed solutions are successfully implemented. User-oriented mechanics is considered the most appropriate way to develop gamification techniques, although it requires a lot of information about the user. The researchers' recommendations for describing a person's profile are criticized due to extreme instability. Moreover, since gamification as a whole is still an insufficiently studied industry, there is practically no amount of local information. Therefore, in our research work, we considered the issue of developing gamification methods that could be effective for students in Kazakhstan. It was decided to propose developing gamification methods based on game preferences, and to do this, a list of the most popular games played by local players was determined. The information was obtained by studying scientific projects, analyzing the website "pinger.kz" and conducting a questionnaire. The students of the courses held on the Moodle e-learning platform were divided into groups according to their gaming preferences and analyzed using the software "Power BI". The study identified "CS:GO", "Dota2", "PUBG" and "FIFA" as the most popular online video games among Kazakh youngsters, and gamification methods based on these results were discussed. Despite the obvious limitations of this work due to the lack of a practical experiment, the necessary information was collected and recommendations for future researchers were prepared.

Аңдатпа

COVID-19 біздің оқыту бағдарламаларымыз толыққанды онлайн форматқа көшуге дайын еместігіне көзімізді жеткізді. Бұл жағдайда студенттер арасында қашықтыдан оқыту процесіне қарасты мотивация және қатысу сезімдері төмендегені мәлім. Әлемдік ғалымдар геймификация механикаларын кіріктіру бұл өзекті мәселенің бір де бір шешімі ретінде ұсынады. Алайда, ұсынылған шешімдердің барлығы сәтті жүзеге асырыла бермейді. Пайдаланушыға бағытталған механика геймификация әдістерін жасаудың ең қолайлы әдісі болып саналады, дегенмен, бұл Пайдаланушы туралы көп ақпаратты қажет етеді. Зерттеушілердің адам профилін сипаттау бойынша ұсыныстары тұрақсыздығына байланысты сынға ұшырайды. Сонымен қатар, гамификация жалпы әлі де жеткілікті зерттелмеген сала болғандықтан, жергілікті ақпарат көлемі іс жүзінде жоқтың қасы. Сондықтан біздің зерттеу жұмысымызда біз Қазақстандағы студенттер үшін тиімді болуы мүмкін геймификация әдістерін әзірлеу мәселесін қарастырдық. Ойынның қалауына негізделген геймификация әдістерін әзірлеуді ұсыну туралы шешім қабылданды және ол үшін жергілікті ойыншылар ойнайтын ең танымал ойындардың тізімі анықталды. Ақпарат ғылыми жобаларды зерттеу, "pinger.kz" веб-сайтын талдау арқылы алынды және сауалнама жүргізу арқылы жиналды. Moodle электрондық оқыту платформасында өткізілген курсының қатысушылары өздерінің ойын қалауына сәйкес топтарға бөлініп, "Power BI" бағдарламалық жасақтамасының көмегімен талданды. Қазақстандық жастар арасындағы ең кең тараған онлайн ойындар ретінде "CS:GO",, "Dota2",, "PUBG" және "FIFA" анықталды және осы нәтижелерге негізделген геймификация әдістерін құрастыру ұсынылды. Практикалық эксперименттің болмауына байланысты бұл жұмыстың айқын шектеулеріне қарамастан, қажетті ақпарат жиналды және болашақ зерттеушілерге ұсыныстар дайындалды.

Аннотация

COVID-19 убедил нас, что наши обучающие программы не готовы к переходу на полноценный онлайн-формат. При этом, как известно, у студентов было снижено чувство мотивации и вовлеченности в процессе дистанционного обучения. Мировые ученые предлагают интеграцию механик геймификации как одно из решений этой актуальной проблемы. Однако, далеко не все предложенные решения успешно реализуются. Ориентированная на пользователя механика считается наиболее подходящим способом разработки методов геймификации, хотя для этого требуется много информации о пользователе. Предложения исследователей по описанию профиля человека подвергаются критике из-за их нестабильности. Кроме того, поскольку геймификация в целом еще недостаточно изученная область, объем местной информации практически отсутствует. Поэтому в нашей исследовательской работе мы рассмотрели вопрос о разработке методов геймификации, которые могут быть эффективными для студентов в Казахстане. Было решено предложить разработку методов геймификации, основанных на игровых предпочтениях, и для этого был определен список самых популярных игр, в которые играют местные игроки. Информация был собран путем изучения научных работ, путем анализа веб-сайта "pinger.kz" и путем проведения опроса. Участники курса, проведенного на платформе электронного обучения "Moodle", были разделены на группы в соответствии со своими игровыми предпочтениями и проанализированы с помощью программного обеспечения "Power BI". В ходе исследования "CS:GO", "Dota2", "PUBG" и "FIFA" были определены как наиболее популярные онлайн-игры среди казахстанской молодежи, и были обсудены возможные методы геймификации, основанные на этих результатах. Несмотря на очевидные ограничения этой работы в связи с отсутствием практического эксперимента, была собрана необходимая информация и подготовлены рекомендации будущим исследователям.

Contents

1. Introduction

Introduction gives the basic information about the work. It leads from a common subject area to a particular topic of inquiry. Section 1.1 explains the reasons of providing this research. Section 1.2 shortly describes the state of literature about the field and explains basic notions. Section 1.3 pinpointed the aim and objectives of the study. Section 1.4 outlines the structure of the paper.

1.1 Motivation

COVID-19 clearly demonstrated that governments worldwide were not prepared for such a large-scale pandemic. The everyday routines of billions of people have changed dramatically in a matter of months. Almost every citizen in the world has felt the consequences of such a sudden event. Taking into account the risks of spreading the virus, in an attempt to preserve the health of citizens, all possible services, including communication methods, were migrated to the online format wherever possible [1].

Due to the quarantined schools and educational institutions, distant learning technologies are in high demand. Despite the advancement of information technology in our time, e-learning is causing challenges for students and teachers all over the world. While the hardware answer is self-evident, requiring server stability and equipment availability, there is no clear solution in terms of software or learning method. Distance-learning systems nowadays have significant flaws in terms of student motivation and participation in the educational process [2].

As part of a young academic society, there was considerable discontent among students, and as a result, complaints about online learning were often heard. Students had difficulties with attending lectures with full engagement. All responsibility for ensuring student involvement rested with the instructors who struggled

to keep students engaged in the education process. Online lectures were difficult to watch, and as a result, the material was poorly mastered even among highly dedicated students who were usually motivated by learning. While some of them often did not attend classes or tended to mute lessons on the hardware level, others tried to listen to the lectures but were constantly distracted by parallel operations like entertainment, domestic chores, and surfing the internet. The challenge was to sit and stay awake, watching only the lecture tab [3]. However, at the same time, the majority of youngsters did not have a problem with just sitting and playing video games [4].

The motivation for trying to solve such a problem appeared right at that point. Why do young people play video games so enthusiastically, and how can the developers apply similar methods in our everyday life, in particular, to improve the methods of e-learning? The answer was in investigating the field around the term "gamification".

1.2 Background

The term "gamification" is defined as "the use of game design elements in non-game contexts" [5]. It uses game mechanics to engage people in a complex area, motivating them with achievements and interactions with game elements to solve problems. However, the idea of using games in a more than entertaining way is not novel. Gamification is a relatively new field in science, which is mostly investigated by computer science researchers [6].

The emergence and development of this industry have been significantly contributed to by the rapid development of the video game industry since the 1980s. The generation that grew up actively consuming media content and was born in the early days of the gaming business is already a part of our society. The number of people playing video games is growing, and this trend was accelerated during the pandemic [7]

The pandemic gives a boost to the game industry and its revenue. In the analysis, global video game sales increased by 20.8 billion dollars in 2019 [8]. The main reason for that is that people had to stay at home because of the restrictions, and anxiety was a common feeling for everyone. A lot of people played video games, and as a result, it positively affected their well-being [9].

While they played to distract and relax, others used video games for even more useful purposes. To illustrate, the virtual reality video game "Half Life: Alyx" that was released just during the pandemic peaked all records [10]. A simple act from a math teacher to get students engaged and provide a lecture in this game contributed to news makers discussing this much [11]. Although it is not a new idea, both researchers and journalists have started discussing the idea of using video games beyond only entertaining purposes and including them in different fields of life [12]. However, there are different ways of making non-entertaining activities more fun and similar to games, and the math teacher's approach is just one of them, but not gamification.

Researchers often get confused when it comes to distinguishing between gamification and related terms like "serious games," "games for learning," and "game-based learning". Despite the terms' common idea, gamification could be applied to a wide audience. The applications and websites that people often use, such as: "Stack Overflow", "Reddit", "AliExpress", et al., already have gamification methods that help engage their audience.

The digitization of education allows new opportunities for integrating gamification methods. The applications like "HackerRank" or "Duolingo" that are popular among students are based on these methods. However, in e-learning, while online lectures are provided by common programs for video calls like "Zoom", "Cisco Webex," or "Microsoft Teams", learning management is conducted on web-based platforms like Google Classroom or Moodle [13]. It is important to mention that Moodle has a feature for adding custom add-ons or plugins, and researchers often use it for gamification experiments.

As a result, gamification techniques would be widely used and integrated into a variety of industries. The development of human-computer interaction has resulted in new instructional methodologies. In the realm of education, gamification is a popular topic. According to a recent study that analyzes the state of research on gamification in education, interest in the sector has been growing for at least seven years [6].

Although the studies confirm the effectiveness of using gamification methods in motivating and engaging people, they do not guarantee positive results. Researchers suggest different methods of gamification with various combinations of mechanics. Points, badges, leaderboards, rewards, et al., depending on the cur-

riculum, context, learning method, and other factors, show completely different results. To bridge these research gaps, it is suggested that the theoretical foundation for gamification design be developed [14].

Therefore, the field of gamification and its application in e-learning need further research. Collecting statistics and data at all levels, conducting questionnaires and surveys, and implementing practical experiments could be very helpful in this area for its further development.

1.3 Aims and Objectives

The main aim of conducting this research was to investigate the field of "gamification" and suggest possible solutions by proposing the actual data for building proper gamification methods for motivating and engaging students during e-learning. In order to achieve this aim, there were formulated research questions and specific objectives, the accomplishing of which would answer them.

To suggest gamification methods that with high probability will work at the local level, there is a necessity in identifying its relevance and building local statistics in order to gather useful data for other researchers. Since the term is not yet widely used in Kazakhstan, this study will also focus on defining a basic concept in order to familiarize the local reader with this domain.

The research questions that the dissertation would answer are:

- What is the relevance of gamification in e-learning?
- What preferences do Kazakh youngsters have?
- What gamification methods would work for local students?

To answer these questions, the following objectives were established:

- To investigate the research field and provide a literature review.
- To conduct research at the local level and provide statistics
- To analyze gathered data and propose possible solutions according to them.

Answering the research questions by accomplishing these objectives would let us propose the most suitable gamification methods for Kazakh students. Achieving this goal will allow researchers and developers to refer to this work in their studies and develop proper gamification methods in e-learning.

1.4 Thesis Outline

The first chapter is the Introduction chapter, which gives insight into the work done. It describes the personal motivation that was the cause of providing the research. The aim and objectives. In Chapter 2 (Literature review) a review for related works was provided and there were formulated the problems to be solved. It also answers the first research question. Chapter 3 (Methodology) explains the methods and resources that were used in the research process. Chapter 4 (Results and Discussion) describes the results of the dissertation and illustrates the findings. Also, it discusses the results and recommendations for future work were described. Finally, the Conclusion chapter, concludes the research.

2. Literature review

In this chapter, the literature review of the thesis is described. It fulfils the first research objective and answers the corresponding research question. Section 2.1 elaborates on the theoretical background of the field of gamification in e-learning. Section 2.2 describes literature about personalised gamification methods.

2.1 Gamification in E-learning

The Oxford dictionary defines E-learning as "a system of learning that uses electronic media, typically over the internet" [15]. Undoubtedly, the technical progress and digitisation of information have significantly contributed to the development of E-learning. In modern society, this is a fairly common type of education that has even been forced to become the only type during the recent pandemic period.

Unfortunately, students attended lectures but did not participate fully. Instructors were solely responsible for assuring student participation. Many of them were forced to make turning cameras on a requirement of online classes, forcing students to expose their personal lives. It helped teachers monitor and hold students accountable. Also, receiving verbal input from listeners made teachers feel more at ease than speaking to a collection of black boxes [16].

These motivational and engagement issues, together with the general dissatisfaction, contributed to the society, including the researchers, to focus on the discussion on the development of E-learning and teaching methods. Local researchers from Kazakhstan in their study about problems of distance learning recommended making changes in the methods of E-learning [17]. This study turned out to not be alone in proposing gamification methods as one of the possible solutions to this global problem. For instance, the survey study of Polish

medical students shows corresponding results. The respondents assessed that they were less engaged in e-learning than they were in studying in regular classes. The researchers suggested integrating gamification methods to boost the interactivity of online learning [18]. The number of similar studies encountered during the search, together with the personal motivation to gather the necessary information, contributed to the preparation of the literature review on the topic of "gamification in e-learning".

This is a review of the scientific literature on educational gamification. This research approach adds to the growth of current knowledge by discovering gaps and patterns in scientific output based on past study restrictions. In order to obtain proper results, it is necessary to determine the criteria for considering studies, interpret the findings, and deliver the review itself. One of the most significant components of a review is the process of picking research articles for study, which includes setting device characteristics to enable critical reading of the chosen content. In general, this literature review is written on the basis of our conference paper [19]. However, there are some additions and updates, and hence several factors have been defined in the context of this study's literature review:

- Additional literature was considered in connection with the publication of new documents since then and the general increase in knowledge in this area.
- The theme of virtual reality, which was discussed along with gamification in the previous work, was not included because of the change in the focus of the research.
- Since it was one of the limitations of previous paper, the local data was included in this review.

The methods of gathering bibliographical literature are described as follows: Scientific papers were searched by Google Scholar. The dynamics of interest in the chosen theme were described using Google trends.

Firstly, there is a point in discussing the concept of e-learning itself. Nowadays, it is a quite defined and widespread term. According to "Computers and Education," a collection of contributions presenting the most recent in the year 2007 research in the field of computers in education, particularly in E-Learning,

there is no single evolutionary tree and no single agreed definition. Since the 1960s, along with the development of the first computers, e-learning has evolved in different ways in business, education, the training sector, and the military [20]. According to Google Trends, E-learning has been widely searched for by people when IT technologies were not widely spread. At first glance, ironically, with the popularity of the Internet and telecommunication technologies, the requests for "e-learning" moderately went down. Apparently, e-learning has steadily become a widely known term. It seems that e-learning has gradually become a widely known and intuitively obvious term, and people are less searching the Internet. However, as is shown in the graph below, the requests for "e-learning" shot to almost their peak after 2020 (see Figure 2.1). It is quite obvious that the reason for such a phenomenon is the COVID-19 pandemic and its restrictions, which have forced traditional learning to be translated into an online format.

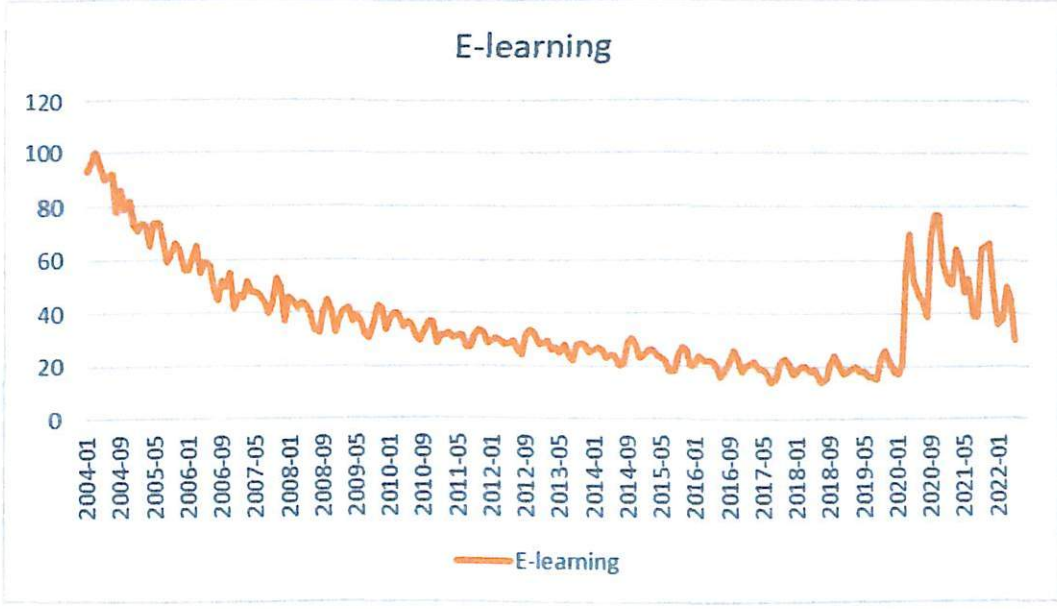

Figure 2.1: Google requests over time for "E-learning" on Google Trends

E-learning has become a hotly discussed topic recently and, rapidly and consequently, problems have begun to emerge. A recent study, which provided a questionnaire among 82 university students (undergraduate and postgraduate), showed that only a quarter of the students preferred E-learning to classroom learning. A quarter of all students are dissatisfied with the education on distance. The authors consider "the lack of motivation and interaction" as one of the possible disadvantages [21].

Recent literature reviews confirm the relevance of the problem. The researchers from Universitas Raharja analyzed 49 studies, including the seven re-

sulting studies from the Scopus database between January and August 2020, and mentioned the lack of motivation as one of the main challenges that students had to overcome [22]. Another study on the topic of E-learning showed that academics face numerous challenges, including cultural, educational, religious, and political issues. They suggested that E-learning could help with gamification skills, which can help students learn more effectively and vividly [23].

Numerous scientists and researchers have proposed gamification methods as a potential solution to motivational problems during distance learning. As mentioned above, some of the studies that confirm this statement. The figure below shows the dynamics of interest in the term "gamification" (see Figure 2.2).

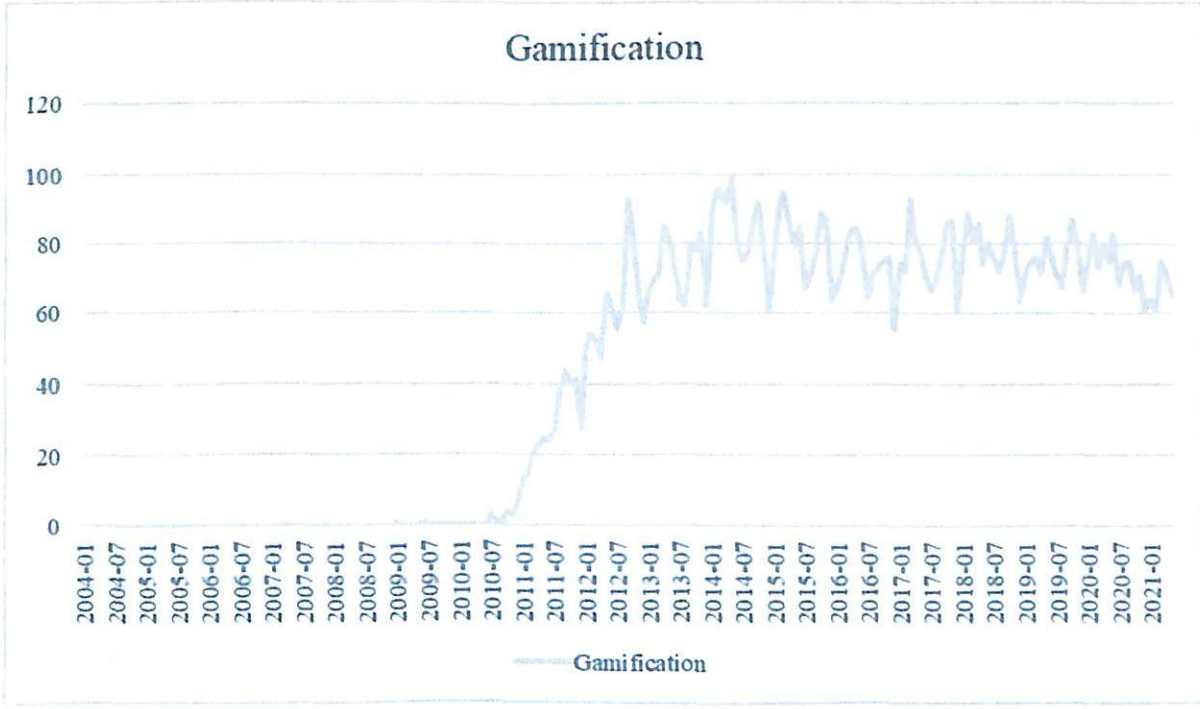

Figure 2.2: Google requests over time for "Gamification" on Google Trends

In 2022, users are familiar with and regularly use gamified apps or utilities. For instance: "Hackerank", "Reddit", "StackOverflow", or "Duolingo". Hence, gamification has already become a part of our digital lifestyle. In the background section, there was already mentioned the term "gamification" itself and its origin. Therefore, the search for literature narrowed to gamification in education.

One of the most common applications of gamification is in the field of education. The findings on Google Scholar support it and demonstrate the narrowing of the sample static when the criteria mentioned in the methodology section are taken into account. The figure below demonstrates studies published at all times (to 2022 May). About 88500 works were found with the keywords "gamification

in education". For the keyword "Gamification in e-learning", 31100 papers were found. And only 293 studies mention Kazakhstan (see Figure 2.3).

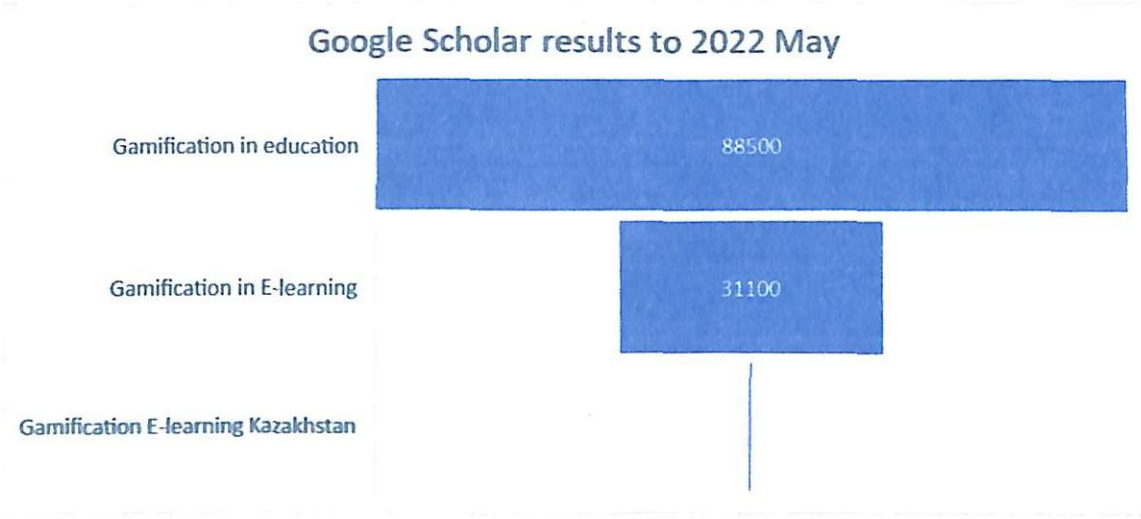

Figure 2.3: Google Scholar results to 2022 by different search keywords

The second figure below illustrates studies published between 2021 and 2022 May. Obviously, there are a lot of papers that are found with the keywords "gamification in education", 18200. The number of papers found with the keyword "Gamification in E-learning" is 7790. Finally, only 97 of them somehow mentioned Kazakhstan (see Figure 2.4).

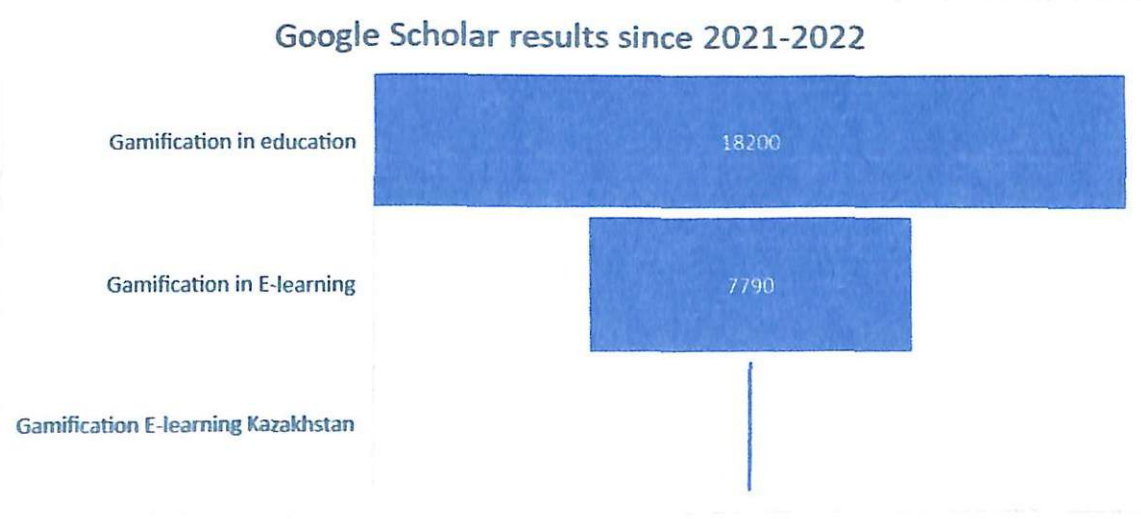

Figure 2.4: Google Scholar results from 2021 to 2022 by different search keywords

There are a bunch of studies that provide experiment results using gamification methods. For instance, Spanish researchers developed their own gamified application for education called HEgameApp and tested it on students. The results concluded that the educational community could do a great deal to improve

the intentions of students by using gamification strategies [24]. During the pandemic, even medical education was on distance type. German researchers piloted an online medical teaching protocol using multimodal, game-based E-learning. These suggested methods were named by students as critical points for e-learning success [25]. Moreover, multiple recent literature reviews on the topic of gamification in e-learning have gathered for us significant results. The researchers from Slovenija conducted the literature review a year before COVID-19, whose work was similar to ours. A meta-study used literature reviews from a variety of academic databases and search engines. Despite awareness of the limitations, such as the possibility of missing relevant literature reviews or wrong interpretations, they concluded that almost all studies report positive effects of gamification mechanisms [26]. In other relevant studies, the field of gamification in e-learning was studied in more detail and the effectiveness of solutions was questioned by researchers.

Overall, the literature review on gamification in e-learning confirms that the current type of education, e-learning, has problems with motivation and engagement. Furthermore, the provided statistics and analysed studies support the promise of gamification's effectiveness in future education. The relevance of gamification methods in e-learning was confirmed. Therefore, the topic continued to be studied in a more efficient way in order to give an idea of the most effective methods of gamification.

2.2 Personalized Gamification

The significant part of the literature reviews noted that, although mostly gamification methods have yielded positive results, their effectiveness has depended on many factors and they do not always solve all problems. The recent concept paper, which was done as a literature review, confirms this statement [27]. Using the COVID-19 pandemic as a lens and backdrop, a Keiser University researcher examined papers from the EBSCOHost and ProQuest databases to examine gamification's design challenges and limitations. The study mentions the gaps in the integration of gamification methods into the education process. It claims that some researchers do not distinguish between games and gamification mechanics. The paper discusses gamification design limitations. There is a statement that

the methods of gamification might have a negative impact on users because of the defectively selected design of the mechanics. The addition of game mechanics can cause the students to stop caring about the content itself. Moreover, overly adding competitive elements can cause additional burdens for students during online learning when they already feel anxious. No instructional design should be based on a one-size-fits-all approach. Students arrive in educational settings with varying academic readiness and metacognitive awareness. Differentiated instruction is the most effective way to address these different levels of preparedness in even non-pandemic situations. As a result, a good gamification design should ensure that the introduction of game elements does not obscure the learners' understanding of the distinction. The study suggests looking into user-centered design, which is usually part of any discussion about learning in a digital environment. It implies that an appropriate gamification design must consider all of the learners' characteristics.

Another useful literature review with significant results was provided by Brazilian researchers [28]. They conducted the review based on the Meta-Analyses (PRISMA) and Preferred Reporting Items for Systematic Reviews protocol. The search was conducted on the Web of Science database, which is widely used by academics. Similarly to the studies mentioned above, this research confirms the trend of gamification and points out its relevance in the educational context after COVID-19. The authors analyzed 130 articles and revealed major features characteristic of the gamification process. Gamification, according to the research, causes students to develop three behavioural attitudes: motivation, engagement, and satisfaction. The framework 7GOALS (Gamification-Oriented Active Learning Steps) is proposed to bring together the main building blocks of gamification and describe them in steps: "user-centricity and personalized experiences", "challenging and clear missions", "narrative and fantasy", "repetitive loops and freedom to fail", "competition and social engagement", "feedback and reflection" and "reward and social credibility". This framework would probably become the basis for further research, including this one. The authors also mentioned several researchers' opinions that gamification should be on a complementary basis during education.

The majority of authors mention different elements of gamification design overall. The researchers from Turkey described the main pros and cons of gam-

ification in e-learning in their literature review [29]. According to the paper, besides technical problems, there is a hesitation about gamification capabilities among teaching staff or university faculty because they are usually uninformed about them. To achieve the desired result, the study recommends that designers pay more attention to the scientific content and exercise caution when using elements of play in the educational process. They should also make sure that most students are familiar with game mechanics and understand the rules. The researchers highlighted points, badges, leaderboards, levels, rewards, feedback, and challenges as the most common elements used in learning. However, other works provided the analyse of gamification elements more deeply and they also claim that the effectiveness of these methods may differ by many factors.

The researchers from Finland provided a useful literature review with significant results [30]. They selected and analysed 128 works and produced in the table gamification elements by their mentioning frequency. The table has more than 30 different elements, and apparently, there is a point in testing and adding new custom gamification methods to this list. Furthermore, they suggest that future research should concentrate on using gamification solutions to promote social interaction. Another similar research by Spanish researchers concluded points, medals, and rankings are the most popular gamification methods in education, which coincides with their colleagues' opinion from Finland [31]. However, they admit that the gamification design should be balanced. As noted in the studies mentioned above, they suggest using more than a couple of methods and reveal that gamification should be student-oriented. Since the article concludes that game mechanics might not be suitable for everyone, it recommends further researchers pay attention to participants' characteristics, including previous game experience.

A literature review on gamification was published in "The International Journal of Human-Computer Studies" [32]. Through a systematic literature review, the authors analyzed related papers and described the state-of-the-art of tailored gamification. They came to the conclusion that in the tailoring gamification process, the authors of these 42 studies mostly used badges and customization while evaluating them with surveys and questionnaires, either as an exclusive evaluation method or in combination with other methods. Motivation and persuasion were the two most commonly used aspects of the tailored gamification evaluation. Al-

most 60% of the studies used tailored gamification in an educational setting, with Moodle serving as the primary virtual learning environment. Player typologies (46%), gender (14%), and personality traits (12%) were the most studied user characteristics. The player typologies proposed by Bartle and Marczewski were used in the majority of the studies that looked into player typology. Five of the six studies that looked into personality traits used the Big Five taxonomy. In Bartle's typology, the following game elements are recommended for each player type: challenges and levels for achievers; collections for explorers; badges, leaderboards, and levels for killers; and guilds for socializers. According to the authors who investigated the Hexad typology, achievers prefer challenges and levels too, free spirits prefer customization and unlockables, players prefer leaderboards, socializers prefer competition and social networks, and disruptor and philanthropist player types are less explored. In terms of gender, the authors suggested that women use badges, customization, leaderboards, and levels, while men should compete. Extroverts should use badges, competition, customization, feedback, levels, leaderboards, meaning, points, and social networks, while people with high neuroticism should use badges, levels, and prizes, and people with high openness to experience should use customization. However, it is important to mention that the authors admit that there are divergences in identifying player types corresponding to gamification methods. Apparently, all these player typologies are only theories, and the scientific community might propose new theories in the future.

Moreover, some researchers criticized these approaches to dividing the players by types and placing them in rigid "boxes" [33]. They claim that the playing style is determined by a large number of variables when, in reality, players have multiple motivations at the same time. People's motivations and behaviours change over time and in different contexts, making it difficult to pinpoint exactly which category they fall into.

It occurs in the case of video games, which are usually popular with a variety of different types of people. Each player has his or her own reasons for playing a game and how they want to play it. Furthermore, it tends to change depending on different factors over time. However, gamers often find new ways and motivation to play the same games over and over.

These statements make us question the idea of proposing gamification methods

based on existing theories of player types. This leads us to consider proposing methods for gamification relative to game preferences.

3. Methodology

In chapter 3, the methods and materials used during the research are described. It answers the second research question. Section 3.1 describes our approach to the research overall. Section 3.2 explains the methods of identifying the most popular games among the local youngsters. Section 3.3 describes the methods of defining students' game preferences. Section 3.4 explains methods of analyzing students' engagement levels. This chapter answers the second question on research, which provides the basis for discussion of the third question.

3.1 Research approach

Our study is intended to propose gamification methods that would probably be useful for the majority of our local students during e-learning. There might be a hesitation at the local level about gamifying such a serious activity as education, especially in Kazakhstan, where digital technologies have begun to be explored relatively recently. Hence, gamification methods should be well designed and properly explained. However, at the local level, there is a lack of information related to gamification itself, not to mention the data about the characteristics of students' gaming preferences. Thus, the need to understand the term "gamification" and how it would work led us to another line of studies to identify the local contingent and their game preferences. Therefore, three research questions were formulated in order to gather all the necessary data, analyze them, and discuss possible solutions based on the findings.

A literature review in the field of gamification in e-learning was provided in order to answer the first research question. Generally, the latest articles were searched by default search engines, while scientific papers were gathered by Google Scholar. The dynamics of interest in the chosen topic were described using Google

trends. When reviewing the materials and analyzing the data, priority was given to the studies published after COVID-19, in order to take into account its significant consequences.

According to the results, the implementation of gamification mechanics based on the tailored method was selected as the method of providing gamification in e-learning. It was identified that it is important to know the audience and their gaming habits. Since game preferences are influenced by a bunch of factors, including the nationality and culture of the players [34], there was a necessity to provide a local study in order to define the society's profiles. Therefore, it was decided to identify the most popular video games among Kazakh players. According to the chart of the most popular games in the world, the majority of the players are engaged in video games that have multiplayer gameplay features [35]. Hence, the focus of the study was on competitive-based online games, which are usually cybersport (eSport) disciplines simultaneously. The studies might confirm this approach because while some of these works recommend focusing on including social interaction with the gamification solutions [30], others particularly suggest gamifying with the elements of competition [36]. Overall, the review of the literature indicated that there were works recognizing the embedding of competitive mechanics as one of the most efficient methods of gamification.

The data collection and parsing process contained several stages for appropriate results. Firstly, a review of the field of cybersport in Kazakhstan needed to be provided in order to pinpoint trends. Secondly, local university students had to be interviewed to compare this data. Finally, the students' data had to be analysed and aligned with their engagement performance during e-learning. There is a hope that this approach would provide the most relevant data for developing gamification methods in e-learning.

3.2 The analysis of Kazakh cybersport

Cybersport is a form of competition that involves playing video games on a competitive basis. Multiple countries have already recognized one of the fastest-growing forms of entertainment as a legitimate sport discipline [37]. According to world statistics, sponsorship and advertising revenue totaled 641 million dollars in 2021, while media rights brought in 192 million dollars. The eSports industry's

global market revenue is expected to reach 1.62 billion dollars in 2024 [38]. However, due to the fact that it is a new and rapidly developing field, there are few scientific studies available worldwide. In particular, there is a lack of knowledge about Kazakhstan's cybersport, which was recognized as an official sport only in 2018 [39].

A platform for Kazakh eSport tournaments called "Pinger.kz" was launched in 2019 with the help of the Qazaq Cybersport Federation. The website has attracted 12000 active users from Kazakhstan, Russia, Uzbekistan, Kyrgyzstan, Turkmenistan, Tajikistan, and other countries in just three months. Users can take part in or watch online cyber tournaments and events through the website. The website's growing popularity attracts young athletes who want to become popular [40].

```
def parse_links(l_url):
    try:
        html = parse(l_url)
        bs = get_content(html)
        buttons = bs.find_all(class_='t-card_button')
        if(len(buttons)==0):
            return False
        for b in buttons:
            a = b.find('a')['href']
            links.append(a)

        return True
    except:
        return False


def parse(l_url):
    html = requests.get(l_url, headers=HEADERS)

    return html

def get_content(html):
    bs = BeautifulSoup(html.text, 'html.parser')
    return bs
```

```
url = 'https://pinger.kz'
links = []

is_true = True
i=0
while is_true:
    i=i+1
    try:
        #print('page '+str(i))
        url_new = url+'/tournaments?page='+str(i)
        is_true = parse_links(url_new)

    except:
        break
```

Figure 3.1: Parsing the website "Pinger.kz"

Since "Pinger.kz" is Kazakhstan's largest platform for hosting cyber tournaments, the data was obtained from the website. BeautifulSoup and requests, and other python libraries were used to scrape the data (see Figure 3.1). Import-

ing pandas libraries allowed to process the data. For parsing a large amount of gathered data, Apache big data analysis technologies are used (see Figure 3.2). Matplotlib was used to illustrate graphs based on gathered datasets.

```
[1]:
spark = SparkSession.builder.appName('dataframe-api').getOrCreate()

Picked up _JAVA_OPTIONS: -Dawt.useSystemAAFontSettings=on -Dswing.aa
Picked up _JAVA_OPTIONS: -Dawt.useSystemAAFontSettings=on -Dswing.aa
21/12/20 09:03:28 WARN Utils: Your hostname, kali resolves to a loop
ad (on interface eth0)
21/12/20 09:03:28 WARN Utils: Set SPARK_LOCAL_IP if you need to bind
Using Spark's default log4j profile: org/apache/spark/log4j-defaults
Setting default log level to "WARN".
To adjust logging level use sc.setLogLevel(newLevel). For SparkR, us
21/12/20 09:03:30 WARN NativeCodeLoader: Unable to load native-hadoo
ava classes where applicable

42]: from pyspark.sql import SparkSession
     from pyspark.sql.functions import col, asc,desc

[2]: users = spark.read.csv('PingerUsersFinal.csv', sep=';',
                            inferSchema=True, header=True)

     df = users.toPandas()
     df.head()
```

Figure 3.2: Apache spark tools

There are 18339 user accounts in this database, with 560 rows of cybersport tournament data. While there are 18309 solo tournament participants, there are also 24121 team tournament participants. Tournament data includes all pertinent information about the event, including title, discipline, date, format, award amount, organizers, and location (see Table 3.1). The user, team, and member records contain all of the information needed to analyze them by country, registration date, and rank.

Dataset	Tournaments	Team Tournament Participants	Solo Tournament Participants
Rows	560	24121	18339
Columns	Tournament, Discipline, Date, Format, Maximum Participants, Organisator, Prize fund, General Partner, Other Partners, Online/LAN, Location	Team, Status, Altel CG, Division, Country, Tournament	Participant, Country, Status, Tournament

Table 3.1: Summary of the gathered information

The goal was to identify and analyze Kazakhstan's cybersport trends. In order to give prospective researchers the actual data about the local eSport, the website

"Pinger.kz" was parsed and the focus was on video games and their popularity. The cyber tournament events shown on the website were counted and sorted by descending order (see Figure 3.3).

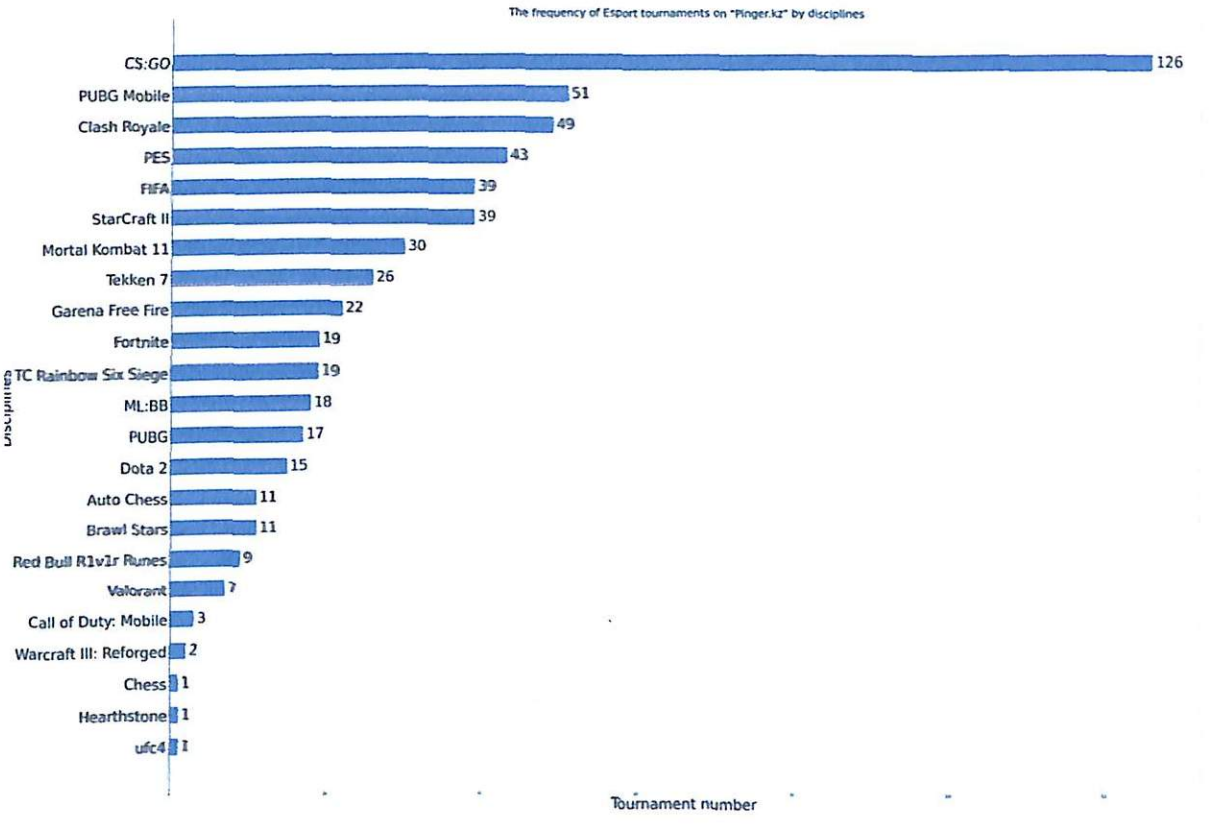

Figure 3.3: The number of tournaments on "Pinger.kz" by disciplines

The results showed fairly unambiguous results. Basically, the most popular video games from this list can be divided into categories like shooters, moba, and football simulators. "Counter-Strike: Global Offensive," also known as "CS:GO," is the most popular game, as seen in the graph above. The graph depicts the number of tournaments held by various sports disciplines. The readers should consider "PUBG Mobile" and just "PUBG" as one discipline, and overall there would be 68 events of "PlayerUnknown's Battlegrounds".

However, the number of events available may not be the only metric for determining a discipline's popularity. As a result, the chart below depicts video games in terms of the total prize fund allocated to each discipline (see Figure 3.4). With a few exceptions, the picture remains largely unchanged. While "CS:GO"

remains the most popular competitive shooter, Dota2 has emerged as the third most funded discipline. In general, the amount of the discipline's prize fund is directly proportional to its popularity, and hence, it is increasing the video game's significance.

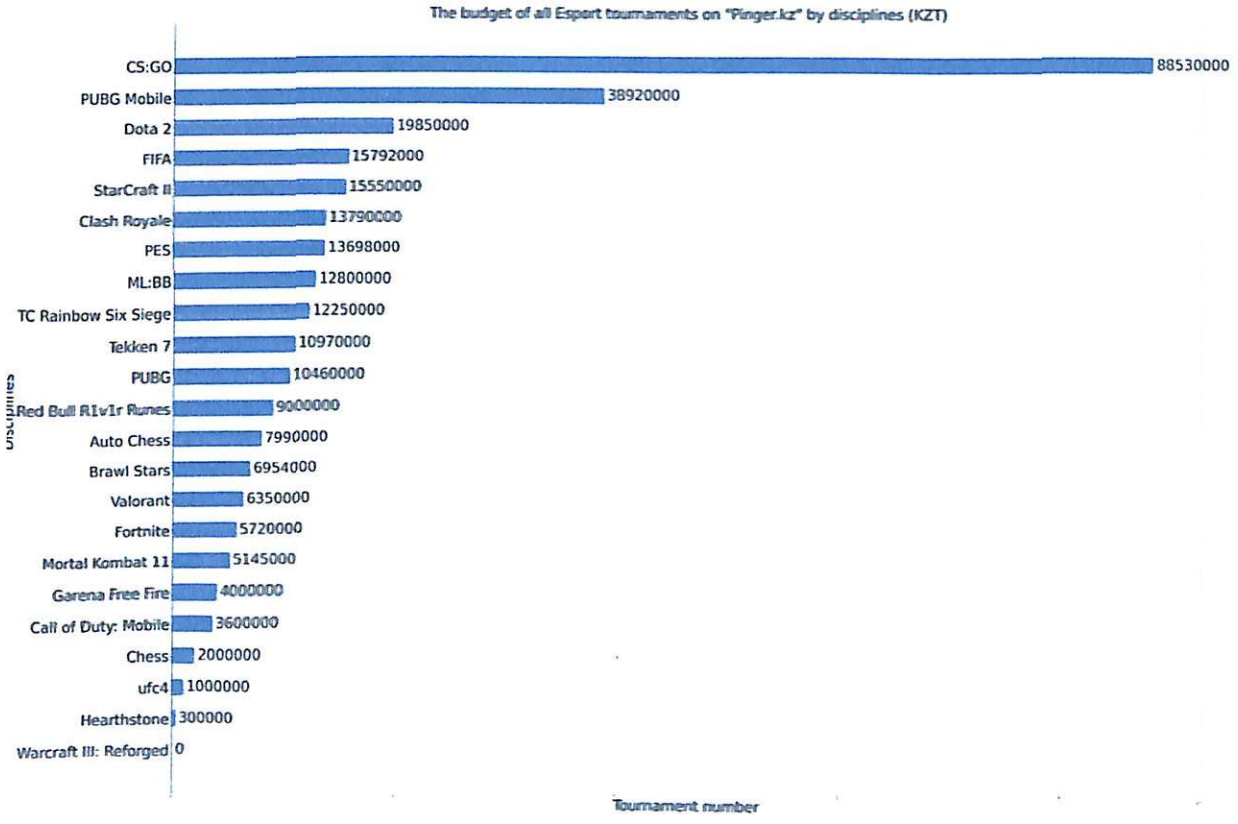

Figure 3.4: Sum of prize funds of tournaments on "Pinger.kz" by disciplines

Furthermore, due to highly funded eSport events for less popular games in the short term, there is a risk of reaching incorrect conclusions. The average fund prize for each event for each discipline could be estimated using the table below (see Table 3.2). By this metric, Dota2 is the most popular video game with at least six events. The number 6 was derived from 5% of the maximum value, which is 126 (CS:GO), as the minimum number of events to consider discipline data significant. As a result, eSport tournaments that have only been held a few times and have a large prize pool per event can be avoided.

Moreover, "Red Bull R1v1r Runes" and "Dota2" can be considered to be one game, because "Red Bull R1v1r Runes" is a temporary discipline of the special

event that was based on "Dota2". In this case, the two most highly funded disciplines turned out to be "Dota2". "Dota2" has 19850000 tenge of the prize fund overall. And if this sum will also be appended to the "Red Bull R1v1r Runes" prize funds, it turned out to be 28850000 tenge.

Discipline	Prize fund (KZT)	Event number	Prize fund / Event number
Dota 2	19850000	15	1323333.33
Red Bull R1v1r Runes	9000000	9	1000000.0
Valorant	6350000	7	907142.85
PUBG Mobile	38920000	51	763137.25
Auto Chess	7990000	11	726363.63
ML:BB	12800000	18	711111.11
CS:GO	88530000	126	702619.04
TC Rainbow Six Siege	12250000	19	644736.84
Brawl Stars	6954000	11	632181.81
PUBG	10460000	17	615294.11
Tekken 7	10970000	26	421923.07
FIFA	15792000	39	404923.07
StarCraft II	15550000	39	398717.95
PES	13698000	43	318558.14
Fortnite	5720000	19	301052.63
Clash Royale	13790000	49	281428.57
Garena Free Fire	4000000	22	181818.18
Mortal Kombat 11	5145000	30	171500.0

Table 3.2: The disciplines that sorted by their prize fund per event

Generally, all these results can be compared to similar data available on the Qazaq Cybersport Federation's official website. However, it should be noted that their data is out of date and does not include any additional information gleaned from "pinger.kz" [41]. No other websites found that would provide data about the video games in Kazakhstan and describe them by their popularity. Foreign websites tend to show statistics worldwide, and usually they do not include the charts for different countries. It could give a list of the most popular video games, because certain games have evolved into eSports disciplines due to their widespread popularity among players. The fact that this or that game has become a discipline in cybersport, generally means the moderate prospective of the video game in the field of competitive tournaments.

The future of a cybersport field might also be confirmed by the numbers. The graph created from the dataframe data below depicted the significant increase in website users since the website's launch in 2019. It displays the monthly number of

website users (see Figure 3.5). It may confirm the dynamics of the growing cybersport field in Kazakhstan. The prospective of domestic eSports does not seem cloudy, but developed, which allows to offer scientific approaches based on these results.

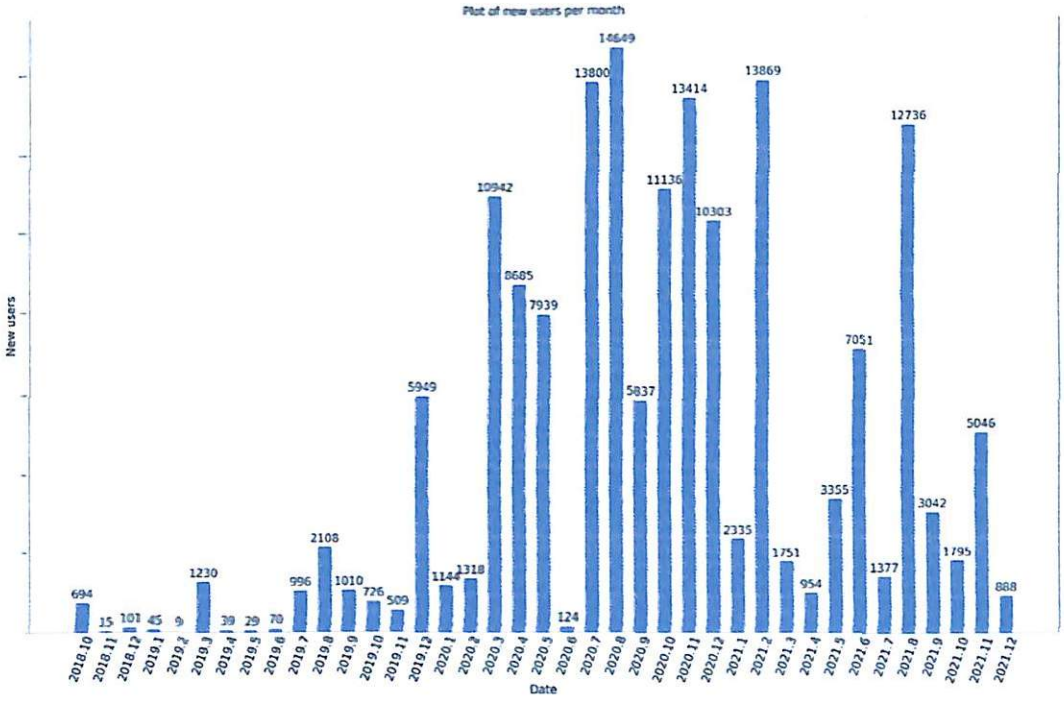

Figure 3.5: The plot of new users per month on "Pinger.kz"

Cybersport is rapidly expanding around the world and will eventually become a serious tournament format. Researchers all over the world have noticed the trend and are attempting to predict society's future by conducting experiments and analyzing data. This article attempted to gather accurate information about local cybersport in order to confirm the global trend. Experiments with Apache's big data technologies confirmed that cybersport is becoming more popular in Kazakhstan.

This study may have some limitations. The website's information may not completely describe the correct information about eSport events. When entering information into a website, there is always the possibility of a human error. Furthermore, the researchers admit that not all of the platform's data was used for illustrating and analyzing. The plan to analyze all the available data turned out to be overly ambitious and pointless. "Format," "Maximum Participants," "Country," "Altel CG," "Division," and "Other Partners" were not properly analyzed or

displayed.

However, the findings provide a moderate picture of Kazakh eSport's current state of development. Based on the results, it can be concluded that the most popular video games among Kazakh players are CS:GO, PUBG, Dota 2, and Fifa. As a result, developers of gamification methods should concentrate on these games in order to create properly functioning gamification elements. Also, the analysis of the Kazakh cyber tournament platform "pinger.kz" provided real-world data to aspiring cybersport researchers.

3.3 Identifying students' game preferences

The analysis of the Kazakh cybersport field yielded useful information about the most popular online competitive video games in Kazakhstan. The popularity of certain eSports disciplines is undoubtedly due to the popularity of these video games among the general public. However, it was decided to additionally verify these results by gathering information from students and at the same time dividing them into groups by game preferences.

Since it was already identified the most popular online video games among Kazakh players, it was decided to split the students into categories defined by the most popular of them. Dividing into categories implies that they should differ from each other in order to make groups really separate. Since there was an intention to suggest gamification methods based on the game preferences of the students, the groups should be defined wisely. It is needed to find a scientific basis for choosing particular games from the list of popular cybersport disciplines.

The conference paper provided by Canadian researchers is found useful for these purposes [42]. Their research contributes to a better understanding of participants' preferences for various games, as well as information about the characteristics of players who enjoy each game. The study they devised, like ours, facilitates the player-centric design and aids designers in creating games or gamification methods that are better tailored to what their target audience wants. They also acknowledge that understanding player preferences can be used to create serious games that are more effective in assisting players in achieving their instrumental goals. By the questionnaire method, they defined games by the game elements in the following Tondello et al.'s framework: 1) strategic resource man-

agement, also including construction and strategic gameplay; 2) puzzle, including diverse types of puzzles; 3) artistic movement, such as music play, painting, or body movement; 4) sports and cards, also including gambling; 5) role-playing, such as fantasy, science fiction, and avatars; 6) virtual goods, including acquisition, collection, and use of virtual goods or resources; 7) simulation of scenarios inspired by real life; 8) action, exciting and fast gameplay; 9) progression towards accumulating power or learning.

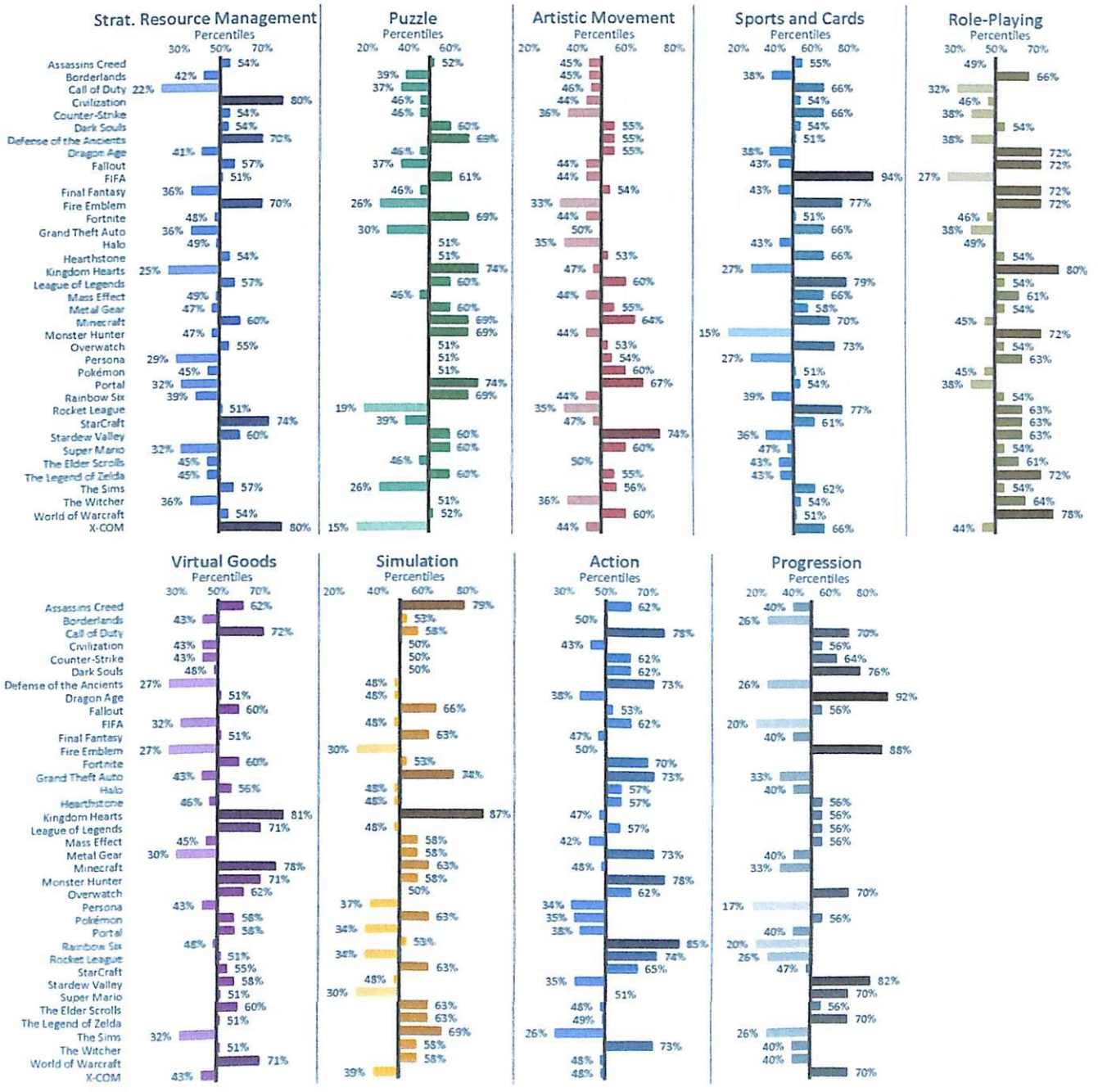

Figure 3.6: Percentile ranks of the Game Elements scores by Game [42]

A bunch of video games were represented by the players' opinions. The focus was on seeking any significant evidence of differences between the most popular

videogames that we identified: "CS:GO" and "Dota2". Fortunately, there was "Counter-Strike" on this list (see Figure 3.6). However, we considered the scores of "World of Warcraft" similar to those of "Dota2" because, initially, it was a mod for this game. After observing the study's results, it was confirmed that there is a disparity between these games. The differences were considered significant when their scales were on different sides of the middle. According to the players' opinion, while "Counter-Strike" has high action and progression game elements, "Dota2" ("World of Warcraft") has a high level of virtual goods elements. Despite the fact that "World of Warcraft" and "Dota2" are not the same game, and the fact that "Counter-Strike" has many versions that also might differ, these results became the basis for our method for dividing the students into three groups: "Counter-Strike players"; "Dota2 players"; and those who really don't have any preferences.

The questions were designed by the discussion with the instructor and PhD student (see Appendix A). There were four mandatory fields for answers: "Student ID", "Do you play videogames?", "How often do you play videogames?", and "Pick the game that exemplifies the type of games you like" (see Figure 3.7).

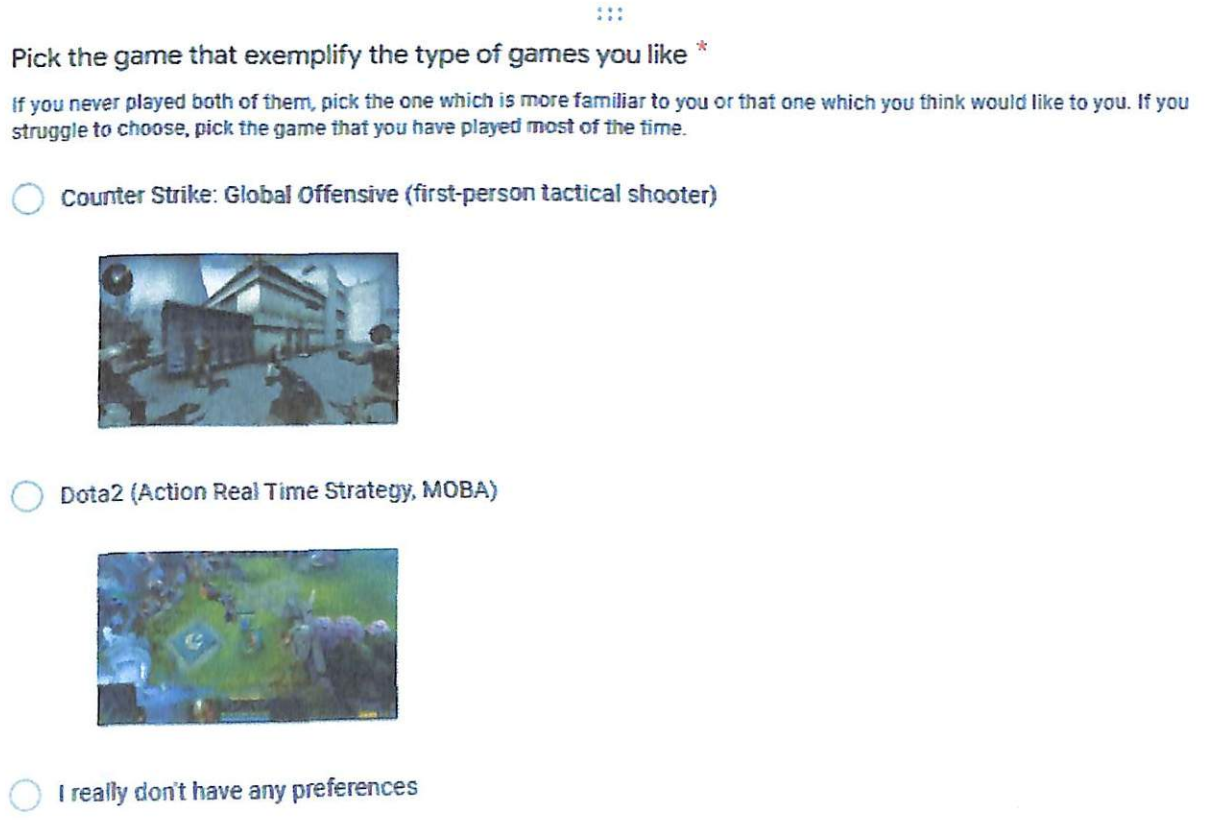

Figure 3.7: The field "Pick the game that exemplifies the type of games you like"

We added the field "Choose up to 3 games that exemplify the type of competitive online games you like" but made it optional in order to let people who never play games also submit their responses. The limit of 3 games to choose was established in order to prevent students from just ticking off all the games that they have ever played. There were 20 video games as options for this field. The list of the options was constructed based on the list of the results of parsing "pinger.kz". As described above, because some of the disciplines on that list are actually the same game, we have merged them and shortened the list of options. For personal reasons, we added to the options the game called "Rocket League", which is becoming popular among youngsters. Additionally, we decided to add other optional questions to gather more information for future research, such as info about MBTI type and Steam ID. A link to the website for taking a psychological test was pinpointed in the description of the corresponding field [43]. This data might be useful for future studies.

Since our target users are university students in Kazakhstan, the method of data collection was by providing a questionnaire among them. Our university became the university where the focus group members of the questionnaire belonged. At first, the questionnaire was proposed for filling out in the local "Telegram" group of the students of Suleyman Demirel University. But then, because of the small number of responses, it was decided to send a link to the questionnaire to the students of the course "Fundamentals of Programming (CSS105)" at the same university, which is situated in Kaskelen, Almaty region, Kazakhstan.

This course was chosen because it was provided online on the Moodle platform. The program consisted of all-year undergraduate students (1-4), which means that the approximate age of the students was between 17 and 22. For some reason, the gender of the students was not taken into account, but access to the information is available and can be determined if necessary. There were no restrictions regarding the devices used for e-learning.

The format of the questionnaire is online, via Google Forms. It was sent to the students via email using their names that we got from the Moodle course. The questionnaire was voluntary for completion, which is very important to note.

3.4 Student Engagement by Game Preferences

Gamification methods are effective if we know the target user as much as possible. Since we have already identified the video games that our target users usually play and even gathered their game preferences by providing a questionnaire in the focus group, we could match all this data with their behaviour during e-learning to better describe the target users.

The students that we interviewed were participants in the course "Fundamentals of Programming (CSS105)" that was provided online. The course took place from September 2021 to the end of December 2021 on the platform Moodle. This e-learning course is an introduction to programming with the Java language and covers the basic concepts of programming.

As mentioned in the previous section, the students' information that we used in order to email the participants the link to the questionnaire was gathered from the log file of the course. The log file has 433876 numbers of rows, which are 92907 kilobytes. The file has the following columns: "Time", "User full name", "Affected user", "Event context", "Component", "Event name", "Description", "Origin", "IP address".

The Moodle platform has the feature for instructors to monitor students' activities on the platform. It is possible by logging the information in the log file that instructors are allowed to download. This file is useful for providing analysis and we use it in our research [44]. Its rows each represent the user's activity on the portal. Hence, one row equals one event, which means, that by counting them we can measure a person's engagement level.

Since we decided to propose gamification mechanics to students in order to engage them in the process of e-learning, it is important to measure their engagement level. It is not easy to measure the interest of students in training, so basically, this scale is approximate. While the majority of the methods proposed by the scientific community were unavailable to us [45], available methods such as questionnaires and surveys that studies usually use are admittedly unsuitable. The results of studies provided by these methods might be biased because people do not always be honest with the interviewers, especially students who might think that their answers would affect their grades.

Hence, it was decided to measure the engagement level of the students by one

of the automatic methods from the taxonomy of engagement detection methods, by analyzing the log file. Moreover, we confirmed the efficiency of this method when we identified that equivalent studies used a similar method as we used [46].

However, as it occurred, there were no students' emails or id columns in the log file. Unfortunately, the log file, along with the syllabus, were the only files explicitly related to the course. Since there was no other data provided, we had to form our own list in order to relate the log file data with the questionnaire results. The students wrote their student IDs to identify themselves when they filled out the questionnaire. In our university, the students' emails have a specific pattern containing their IDs and university domains.

Hence, we had to get students' IDs from their names that are in the log file. However, by using "Selenium", we could automate the process of writing the names in "gmail.com." where users can send a letter knowing only the name of the recipient because of cooperative mail. This process would be absolutely unnecessary if researchers had all the necessary information from the beginning, but we thought it was important to mention it even if it is unrelated to the study explicitly.

Thus, we succeeded in sending an email to the student asking them to fill out the questionnaire. Then, by typing some lines of code in Python, we could construct the list of names and IDs that we further used in our data model in order to relate the log file with other notes.

```
id_list = idstr.split(',')
attar = []
idlar = []
for s in id_list:
    start = s.find("<") + 1
    end = s.find("@")
    id_i = s[start:end]
    at = s[0:start-1]
    at = at.lstrip().rstrip()
    #final_username = username.replace("_", "")
    attar.append(at)
    idlar.append(id_i)
```

```
df_ids = pd.DataFrame(list(zip(attar, idlar)),
                      columns =['User full name', 'id'])

df_ids.to_csv("idlar.csv")
```

We had to connect this data with the other notes that had been gathered before. The main purpose was to relate students' behaviour during e-learning with their game preferences. We hoped that this perspective relationship between these variables would give additional valuable information in order to develop appropriate gamification methods.

Hence, we decided to use "Power BI" to provide such analysis. This software, which is supported by "Microsoft," allows us to connect and visualize any data using a unified, scalable platform for various purposes, allowing to gain a better understanding of the data.

By using "Power Query", we modified the lists into the right format. It allowed to connect the lists with each other (see Figure 3.8).

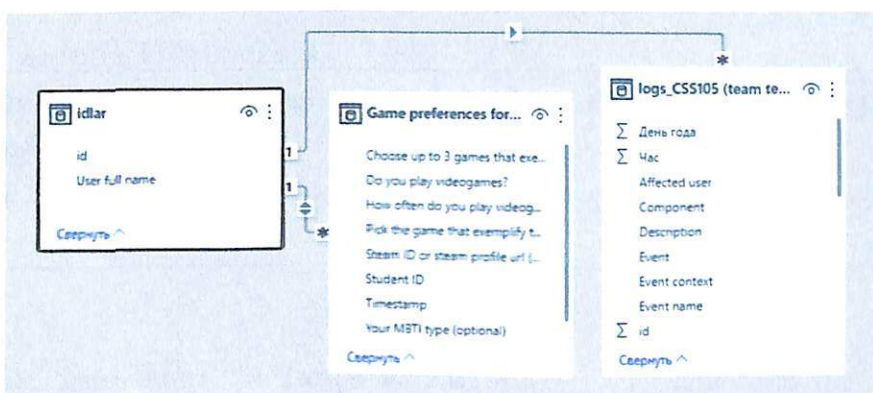

Figure 3.8: The field "Pick the game that exemplifies the type of games you like"

The engagement level of the students was measured for groups of students by game preferences. In order to avoid a wrong interpretation of the result, we have to take into account the number of people in each group. For instance, students who belong to one group may be more than students in another group. If we take into account only event counts, the chart of people's scores in one group will be much more than in the other. However, it does not mean that the students of a particular group are really engaged because they might just be more in the group. For this reason, we have to divide the number of distinct events by the number of people in each group.

$$E = \frac{x}{n}$$

where:

E = engagement level by groups (average event count for one student of the group)

x = count of distinct events

n = number of students in group.

The measure according to this formula gives the average number of events per student group.

In "Power BI" the measure was written as follows:

```
Engagement =
DISTINCTCOUNT(logfile[Event])/DISTINCTCOUNT(idlar[id])
```

However, the possible inaccuracy associated with the different number of students in different groups. Therefore, probably, it is better to consider and look at the level of involvement relative to the time within one group, rather than compare them among themselves.

Additionally, a new measure needed to be added that would represent the week number of the date.

```
let
   // ...

    #"Вставлено: день года" = Table.AddColumn
        (#"Вставлено: часы", "День года", each Date.DayOfYear
            ([Time.1]), Int64.Type),
    #"Вставлено: деление" = Table.AddColumn
        (#"Вставлено: день года", "Деление",
            each [День года] / 7, type number),
    #"Округлено вниз" = Table.TransformColumns
        (#"Вставлено: деление",{{"Деление",
            Number.RoundDown, Int64.Type}}),
    #"Переименованные столбцы" = Table.RenameColumns
        (#"Округлено вниз",{{"Деление", "WeekSeq"}}),
    //...
in
    #"Переупорядоченные столбцы1"
```

This measure adds a corresponding week number to each event. It allows you to sort data by semester week number and show diagrams according to it. By adding this measure to the date hierarchy, we can illustrate the corresponding diagrams with engagement level by group and by week number.

Thus, the methods of identifying students' engagement levels by game preferences were explained. Due to a lack of experience in conducting such scientific experiments, the methods have limitations. However, this description of our methods might be useful for other researchers who were interested in choosing an approach similar to ours.

4. Results and Discussion

In this chapter 4, the results and findings of the study were discussed. Section 4.1 illustrates the results without any interpreting. This section answers the second research question. Section 4.2 discusses possible interpretations of the results and describes limitations of the study. In this section, the objective that answers to the third research question is done.

4.1 Results

The study results were gathered from different sources. After a review of the literature, the study directions are determined. Based on the review results, scrapping of the website was carried out, which allowed for the conducting of a questionnaire and subsequent analysis of the involvement of students.

The analysis of the most popular online platform for the cyber tournaments in Kazakhstan "pinger.kz" showed the state of the Kazakh eSport field. By the parsing of the website, the data was gathered and served as a basis for further experiments.

First of all, the findings of the questionnaire confirmed our hypotheses. Its results matched the data from "pinger.kz" (see Figure 4.1).

The most popular online games on a competitive basis in Kazakhstan are:

1. CS:GO
2. Dota2
3. PUBG
4. FIFA

Other games are also popular, but they are not as massive as these four games.

The questionnaire was submitted 102 times by the students of Suleymen Demirel University. The Google Form has open access and they could submit it several times. Therefore, its results might slightly differ from the study's results.

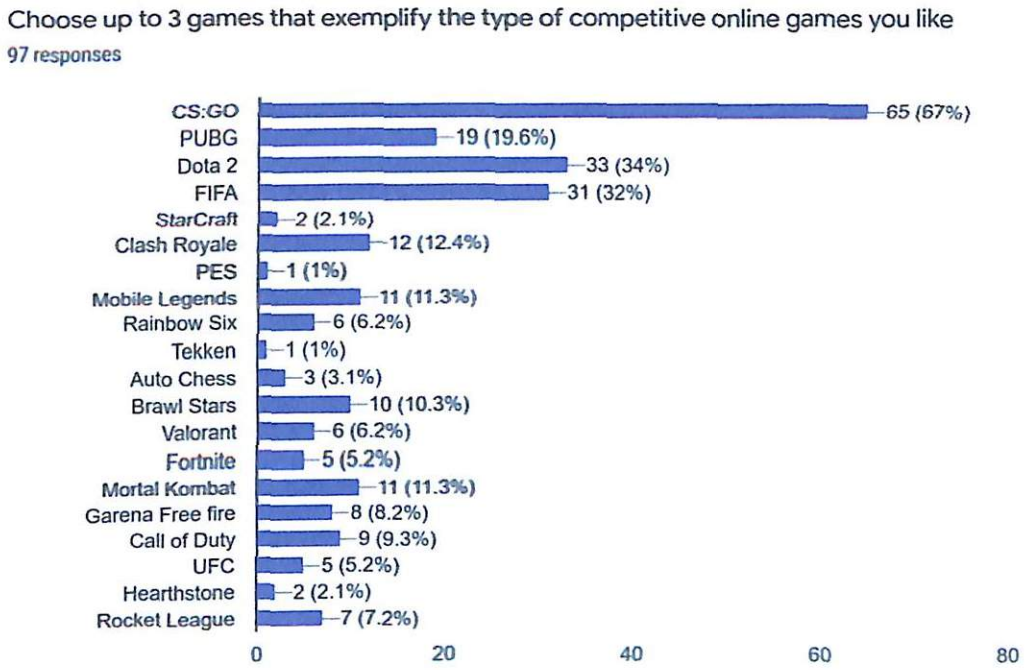

Figure 4.1: The distribution of video games according to the questionnaire

The students who prefer "Counter Strike" are about twice the group that prefers "Dota2" (see Figure 4.2).

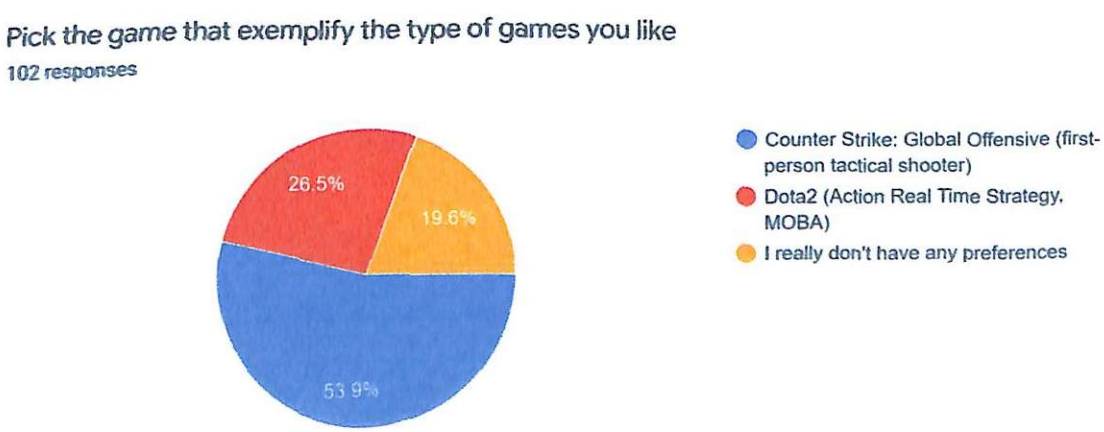

Figure 4.2: The distribution of video games according to the questionnaire

There was also the question, "How often do you play video games?" (see Figure

4.3). These scores might be helpful to understand how significant their responses are. By these results, addicted players could be distinguished from others.

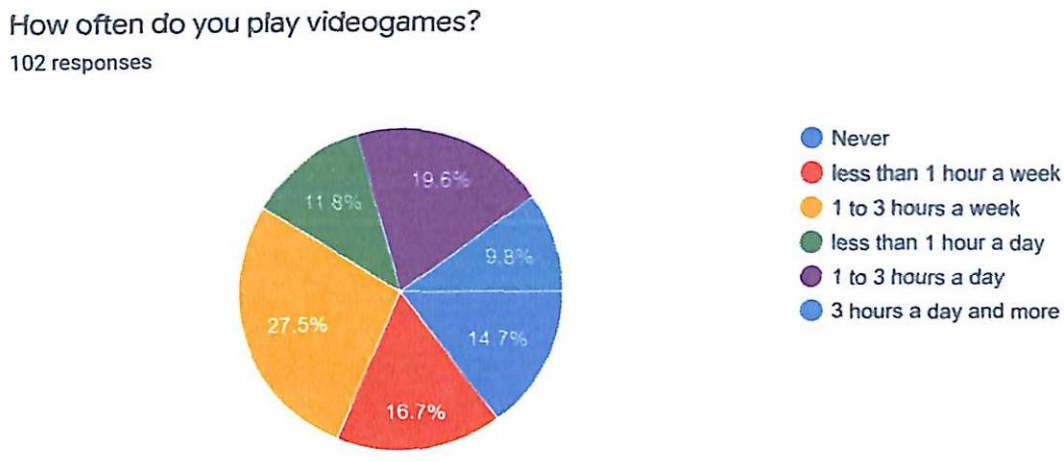

Figure 4.3: How often do students play video games?

In order to identify the gamers, ex-gamer and non-gamer students' preferences there were added a simple question, "Do you play video games?" (see Figure 4.4). By this, it can take into account preferences of the students who used to play, but no under some circumstances do not do it now. Also, there are might be people who really prefer one game to another but at the same time do not play video games at all. The responses of one group might be considered as more valuable than others, because of the experience they have.

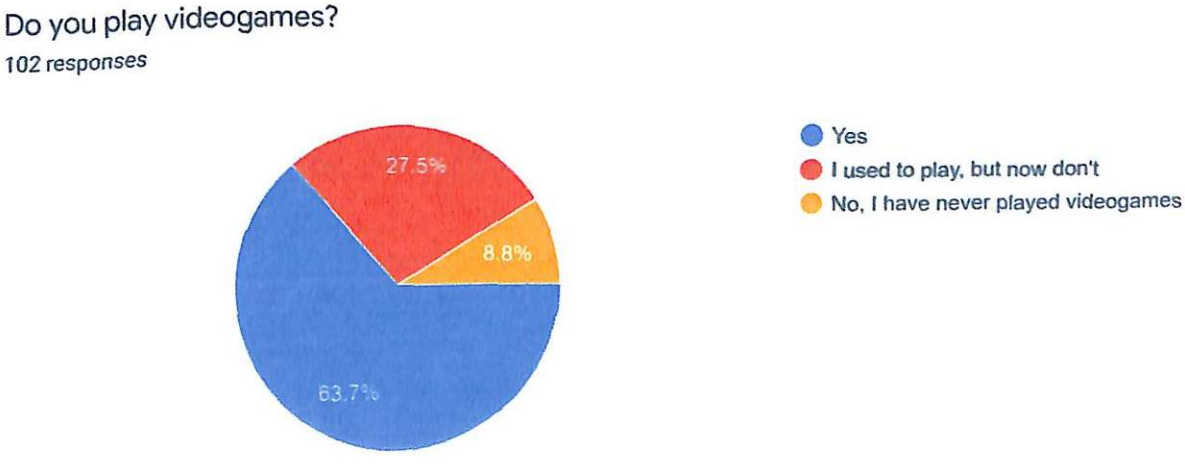

Figure 4.4: Do students play video games?

The results provided by "Power BI" could have too many representations.

Therefore, this section would show only some primary results.

On these diagrams the students grouped by the preferences as follows:

- "Counter Strike" are colored with light blue
- "Dota2" are colored with dark blue
- Students with no preferences are colored with orange

There are two events that somehow better than others imply interest of student toward the course. They are "Course module viewed" and "Course viewed" .The following diagrams shows the results that took into account only this type of events.

CS:GO

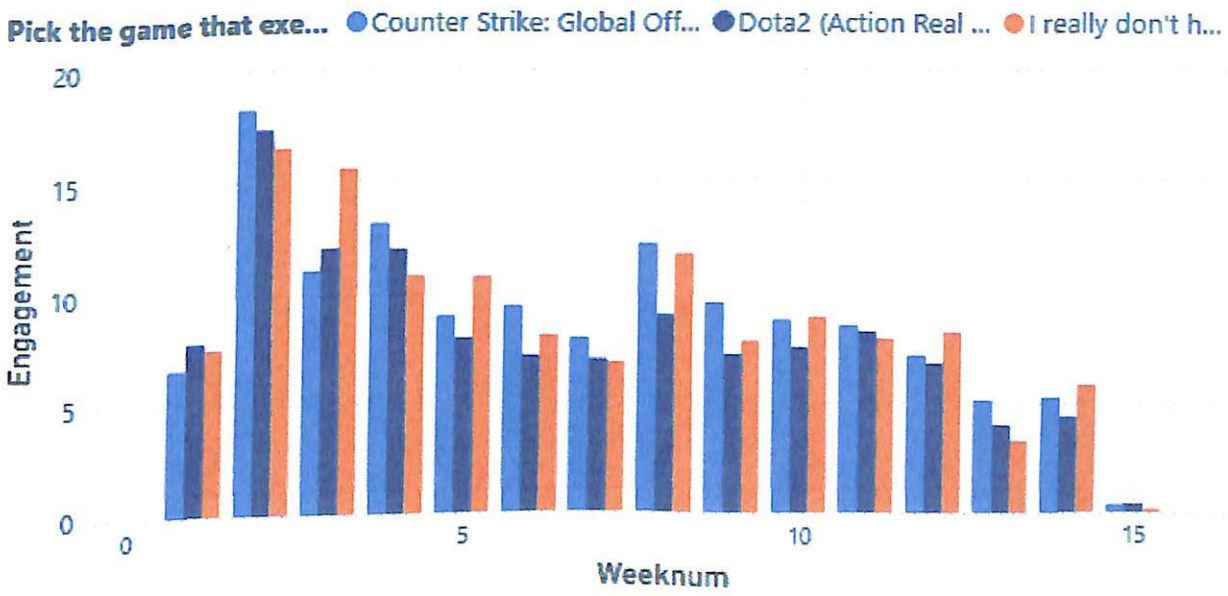

Figure 4.5: Engagement level by week and game preference with filter

This diagram shows the count of events per student in different groups (see Figure 4.5). It takes into account all students, including those who do not play video games but have certain preferences. The score reached a maximum of 18 events for a student in the group, and decreased to 3 events for a student. On average, the number of views of the course module by each student is 8 for a week. It is important to mention that the orange-colored group consists of students who have no preference between "CS:GO" and "Dota2" but play other games, as well as students who do not play games at all.

As it was mentioned in the methodology chapter, in order to get the engagement level for a group, the count of events for a group was divided by the number of their members and got the average number of events that each student in a group did on an average.

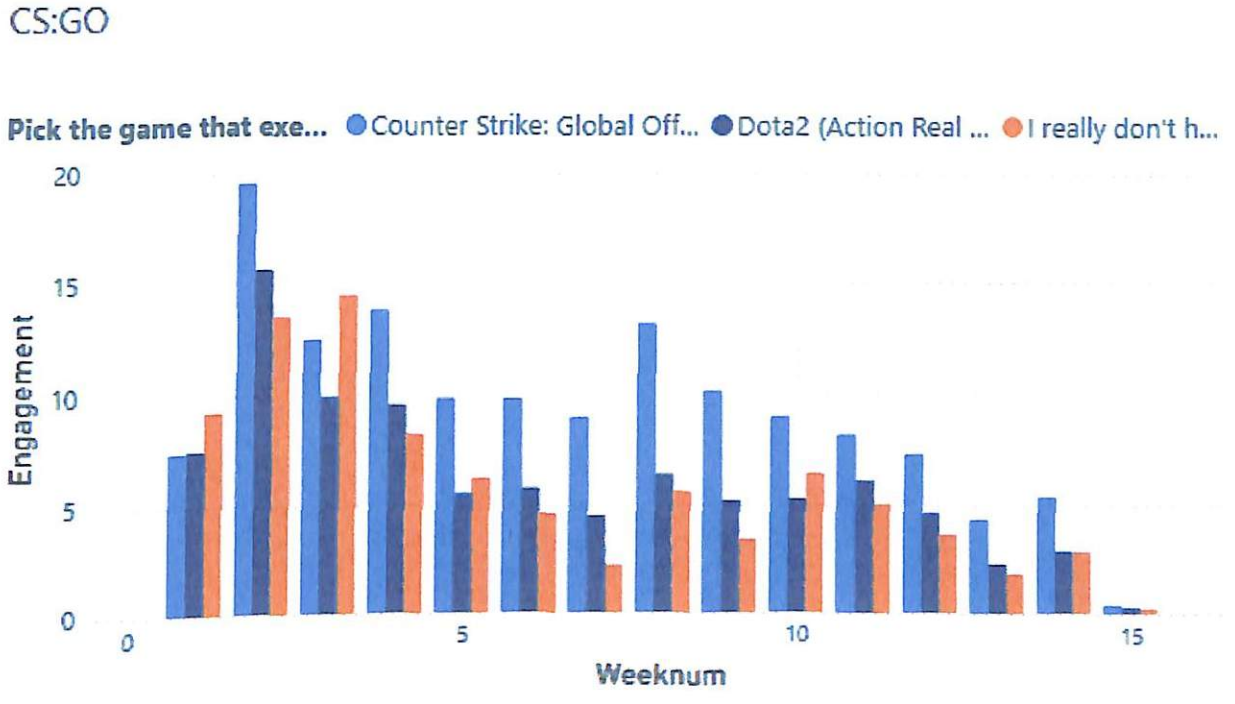

Figure 4.6: Engagement level by week and game preference with filter

Figure 4.7: Activity on the website depends on the time

The second diagram also shows the level of willingness of students to game preferences for the period of study. The filter by one of the question was applied to this diagram, and therefore it only takes into account students who play video games (see Figure 4.6). In this situation, the maximum number peaks at 20, while the minimum is 2. On average, each student does 7 events a week, which is 1 for a day.

This graph shows the student's activity relative to time (see Figure 4.7). This time, a different method of determining involvement was used, and the total number of events was not divided by the number of students. A simple count of events for an hour was measured. The maximum number of events occurs in the evening of the day at 7 o'clock, while the activity is naturally close to zero at night from 3 to 7 AM.

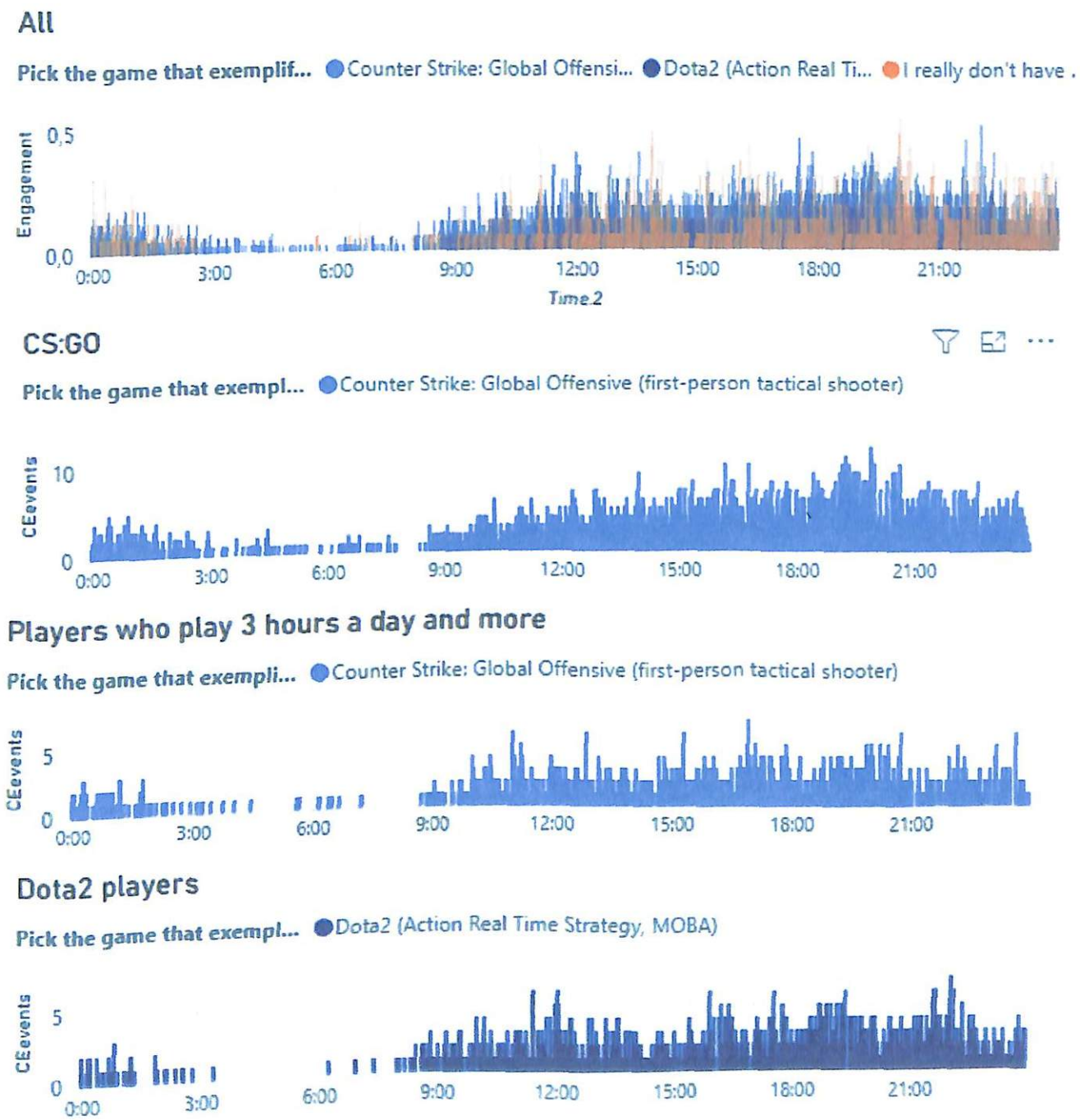

Figure 4.8: Activity on the website by game preferences and time.

There is a necessity to identify at what time the students of the particular group do enter the course's page on the platform. The following diagram compares

different types of students by the exact time when they opened the course module page (see Figure 4.8). It allows you to see and compare the students' levels of interest in the online course by their game preferences and even consider how often they play games. As shown, there are only "CS:GO" players among the students who play for three hours a day or more.

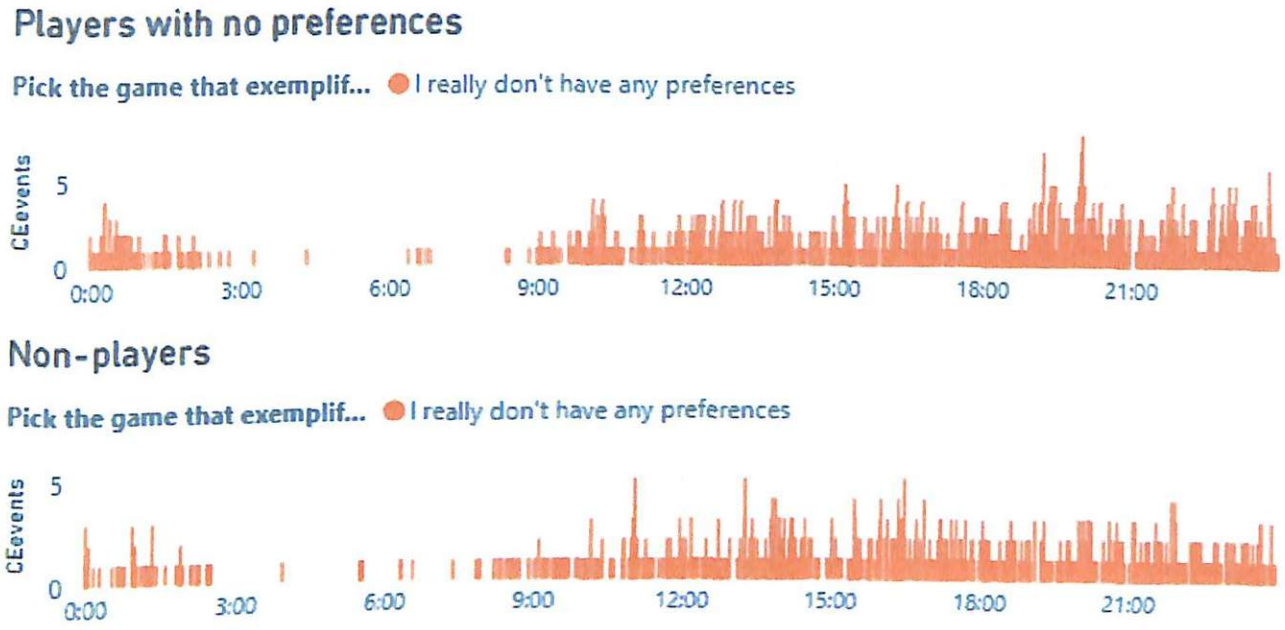

Figure 4.9: Activity of the students with no game preference

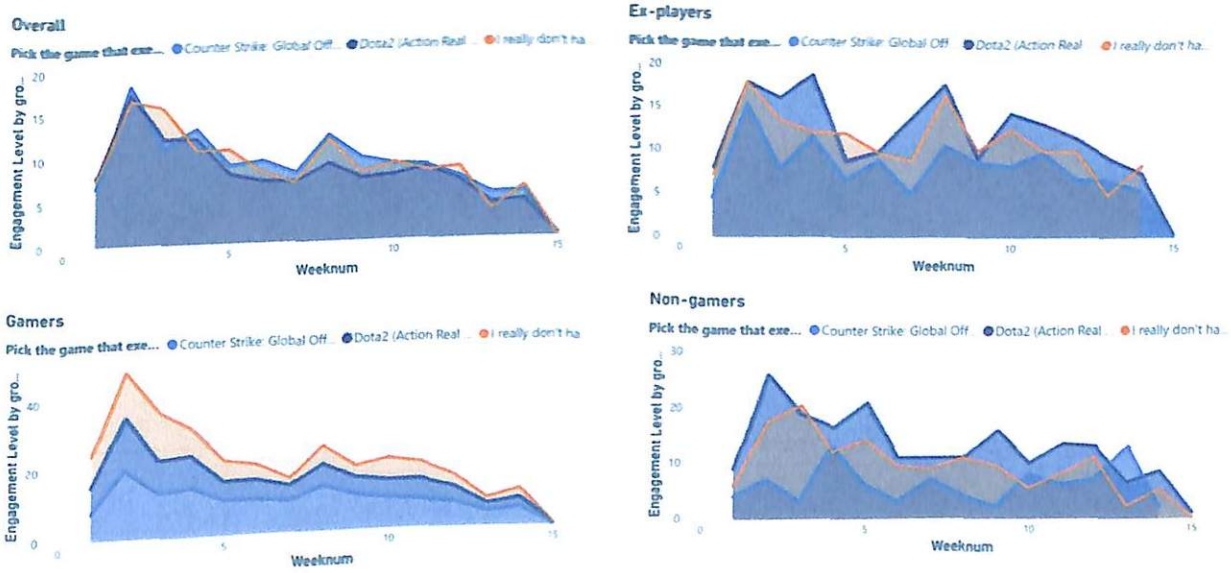

Figure 4.10: Different types of students' engagement by their gaming habits

The second figure with two diagrams shows the activities of the students with no game preferences by exact time (see Figure 4.9). The first of the diagrams

illustrates students who actually play, but prefer neither "CS:GO" nor "Dota2", while the second diagram shows students who do not play video games at all.

There are 3 categories: those who play video games; those who used to play but now do not; and those who do not play at all. Each of them has own game preferences, even if they do not play video games now (see Figure 4.10). This time, the engagement level was measured by dividing it by the number of the group members.

Finally, the distribution of the students by their game preferences and habits is illustrated in the following figure (see Figure 4.11). The strict distribution by preference between only "CS:GO" and "Dota2" shows that there are 40 students who prefer "CS:GO", 17 students prefer Dota2 and 16 students prefer neither of them. Only 29 of "CS:GO" players and 12 of "Dota2" players play the video games regularly. Another 5 students prefer other games.

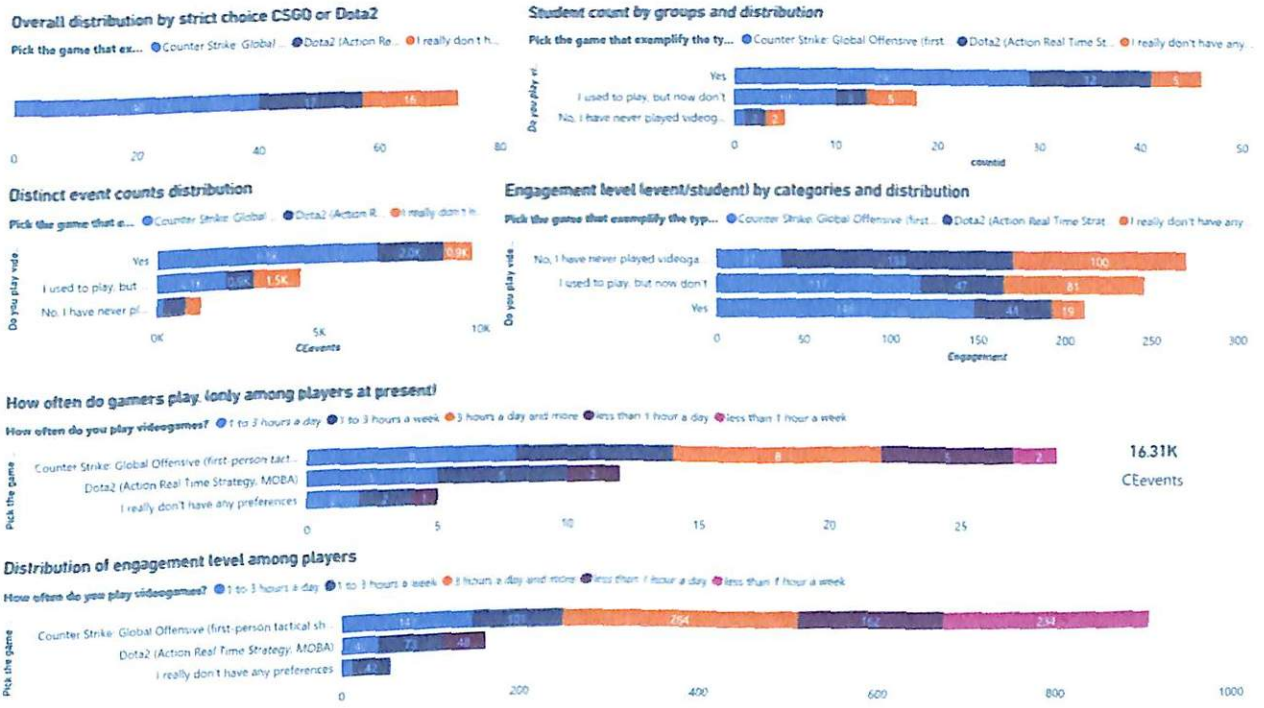

Figure 4.11: Different types of students' engagement by their gaming habits

Overall, there were over 16,310 events during the education process. The category of the students that contributed the most is the group of players, with 6,800 events from "CS:GO" players. "Dota2" players did 2000 events. The ex-players of "CS:GO" did 2100, while the ex-players of "Dota2" did only 900 events.

It also describes the engagement level for each of the groups of students. By dividing the event count by the number of students in the groups, it shows the

average number of events for a student in a particular group. It describes current players as the least engaged and non-players as the most.

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It also describes the engagement level for each of the groups of students. By dividing the event count by the number of students in the groups, it shows the average number of events for a student in a particular group. It describes current players as the least engaged and non-players as the most.

The figure also illustrates the distribution of the players by their gaming habits. Generally, students who prefer "CS:GO" play for an hour a day to 3 hours or more. The players who prefer "Dota2" spend from 1 to 3 hours a day or week.

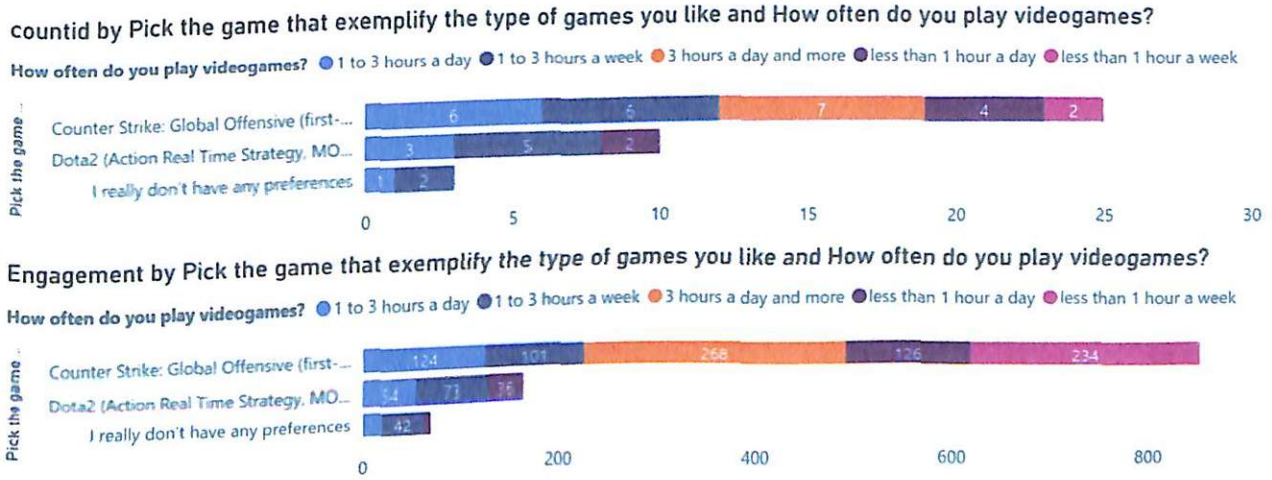

Figure 4.12: Different types of students' engagement by their gaming habits

The diagram shows the same picture but with an applied filter that includes only players that chose "CS:GO" and "Dota2" as games that exemplify the type of video games that they like (see Figure 4.12). At this time, it shows only players who really play "CS:GO" and "Dota2". The students who have the most events per student remain "CS:GO" players who play 3 hours a day or more.

4.2 Discussion

In this article, there was an intention to study the term "gamification" and propose an approach to the development of gamification methods that will probably work for Kazakh students.

Correspondingly, the primary goal of this study was to look at the topic of "gamification" and offer feasible answers by presenting real-world data for developing effective gamification approaches for inspiring and engaging students during e-learning.

To attain this goal, the study questions and particular objectives were devised, the fulfillment of which would provide answers.

It was necessary to establish its significance and develop local statistics in order to acquire meaningful data for other academics in order to suggest gamification strategies that are likely to succeed at the local level. Because the phrase isn't widely used in Kazakhstan, this research concentrated on developing a basic notion to familiarize local readers with the subject.

The dissertation addressed the following research questions::

- What is the relevance of gamification in e-learning?
- What preferences do Kazakh youngsters have?
- What gamification methods would work for local students?

The following objectives were created to answer these questions:

- To investigate the research field and provide a literature review.
- To conduct research at the local level and provide statistics
- To analyze gathered data and propose possible solutions according to them.

The results of the study may be useful to researchers applying a similar approach. Gamification techniques can be developed based on students' favorite games. Games use mechanics to lure many people into addiction, which allows these games to become very popular.Students lacked involvement and motivation to study when it came to online learning, but online video games were often able to attract them much better. These mechanics can also be applied in e-learning in order to make learning as enticing as online games.

There were provided the results and they can be analyzed by other researchers in this field. Our literature review will be useful for new researchers in the field of gamification to get an overview of the sphere and to identify existing methods of gamification. It answers to the first research question.

The results of the experiments conducted during the research identified the students' game preferences. The results section answers the second research question and gives background for answering the third research question in this section.

The literature review explains the basis and describes the state of research in the field of gamification in e-learning. It identifies the relevance of these research fields and pinpoints current problems. E-learning has become a popular topic of discussion, and integrating gamification methods is really one of the solutions. By providing examples from other works with practical experiments and citing other literature reviews, the review answered the first research question.

A user-centered approach to development is defined as the best approach for developing gamification methods in the review. It demonstrates that the methods proposed by most researchers to determine the type of player are unstable. Developing gamification methods based on these theories seems like an unstable idea. However, recently published works provide gamification mechanics based on them. While some works acknowledge that people are not one type and that they can adapt to multiple groups of profiles at the same time, many players' styles and motivations change over time for a variety of reasons, even if they can play the same games. It leads to the idea of proposing gamification methods based on game preferences. So, by reading our literature review and looking at our work, the reader can evaluate this approach of developing gamification methods based on game preferences.

In order to propose gamification methods that would probably work for the majority of the students in our country based on their game preferences, it was necessary to identify the most popular video games that they play. According to world statistics, the most popular video games are competitive online video games. Hence, the focus was on only multiplayer online video games that are popular in eSports. It was decided to parse the local cybersport platform for tournaments "pinger.kz". The results give the list of the most popular video games among Kazakh players.

A list of the most popular online games in Kazakhstan was defined, and the

local questionnaire among students confirmed this data. Despite its limitations, the results showed that "CS:GO", "Dota2", "FIFA" and "PUBG" are the most popular video games on a competitive basis among the students too. This data partially matches with the world's tendency, because "CS:GO" and "Dota2" are the most popular video games in the world. The strict mandatory question divided the students, and the results showed that more than half of the students prefer "CS:GO" to "Dota2". Also, they showed that the majority of the students who submitted the questionnaire play video games regularly.

In order to identify a possible dependence in behavior among the students of particular groups, it was decided to align students' game preferences with their engagement level during e-learning. The students were divided into two basic categories based on the two most popular video games identified previously: "CS:GO" and "Dota2". Also, these video games differ from each other. It would give the researchers valuable information about tailored gamification based on game preferences.

However, the results did not show any significant differences between the groups of students as it was expected. The analysis shows the results, but the interpretation of these results might be tricky because of their limitations. For example, the groups do not have an equal number of students. That might significantly affect the engagement level, even if the overall number of events was divided by the number of people in the group. The diagrams show that the "CS:GO" group has the highest level of engagement, but it has to be tested in an experimental way.

The engagement level rises and falls among all students relatively equally. Basically, the 15-week course had two parts (see Figure 4.5). The engagement level is at its peak in the second week, just after the introduction lesson on the first week. Then gradually it goes down till the half of the semester. At the half of the semester, the activities on the Moodle portal grew again, but rapidly. After that, it goes down to the end of the course.

There is a possibility to take it into account in the development of gamification methods. They might be focused on these periods of falling engagement levels that are the end of the two semester halves. For example, the methods might be in the form of challenges that encourage students to take action on the website.These challenges should change every week in order to get the students engaged.

The most popular time to view the course page is 7 PM. It might be because the students worked full-time and could do their homework only after they came home. There is an opportunity to integrate a bonus system for doing home work in the daytime when they are not tired.

The analysis of the engagement level by time shows significant results. The results demonstrate that non-players tend to view the course module during the day more than gamers (see Figure 4.9). The gamers' behaviour might be caused by the circumstances of gaming or procrastination.

"CS:GO" players have a rapidly falling engagement level at 9 PM (see Figure 4.8). According to the statistics, 3 PM UTC, which is 9 PM for our country, is the time that "CS:GO" has the peak number of players (see Figure 4.13). It might be a coincidence, but it should be taken into account.

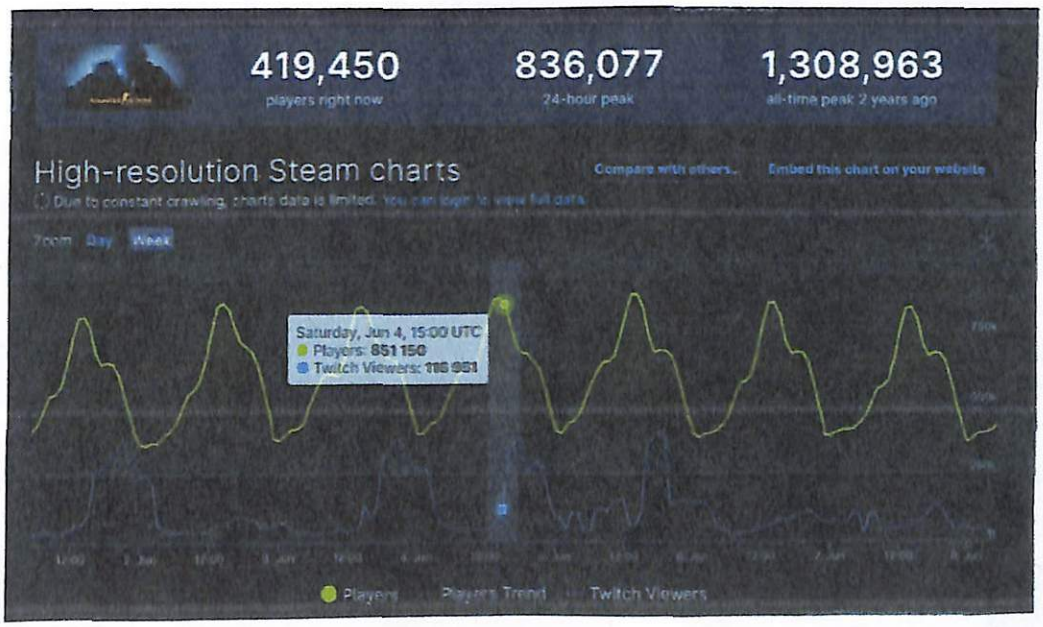

Figure 4.13: "CS:GO" engagement level [47]

Another diagram shows the differences between different groups and the distribution of engagement levels among them (see Figure 4.11). Overall, the results show that current gamers had the lowest engagement level, the ex-gamers were just above them, and the non-gamers group had the most events per student.

For some reason, the result of engagement distribution among players shows that "Dota2" players are not engaged in education, while the most engaged type of players are "CS:GO" players who play 3 hours a day or more. It definitely should be re-observed because it looks unrealistic.

In the future researches, it is recommended to provide a study with developing

gamification methods based on this approach and data. It should be tested in experimental way among students. Also, additional data collection might be found useful, such as: students' engagement level during the online lectures, analyzing game hours by "Steam ID" or providing additional questionnaires.

This screenshot of the game below probably precisely represents the game mechanics of engagement (see Figure 4.14). This window shows up when the game is over. This feature, which includes multiple mechanics at the same time, probably helps engage people better than the game itself. It has a leaderboard in the center, virtual goods on the right, achievements on the top, and progression mechanics below. This collection of game mechanics operates on each of its users and, probably, together they makes this game the most popular competitive online game in the world.

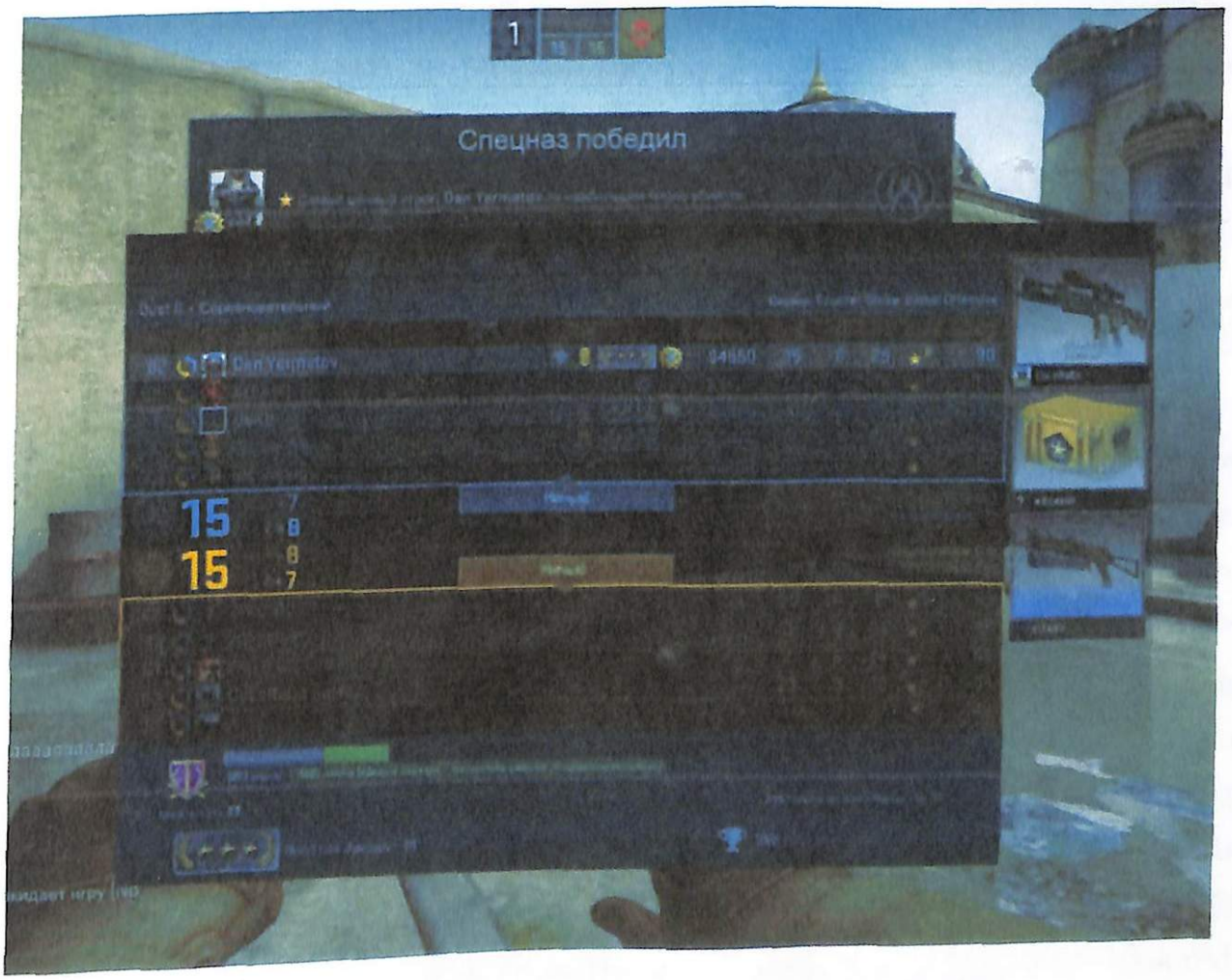

Figure 4.14: The screenshot of the game "CS:GO"

4.3 Limitations

There are some limitations that can affect the significance of the study's results and conclusion. The majority of them are related to the methods and results. Due to inexperience and a lack of information, the study could not accomplish some of its initial ideas.

In the beginning, the idea was to build a whole gamified web-service or application for education and provide experiments to prove its effectiveness. Unfortunately, it turned out to be too ambitious, also it was admitted the probability of that time planned for providing the research was not allocated correctly. As a result, the dissertation is limited to theoretical proposals, although it prepared the basis for practical research and gathered useful information for future research.

The focus of the study was on online competitive games for several significant reasons. However, there are also many players who play other types of video games, such as single-player games or games with a narrative, that use other mechanics. Usually, the types of players who play single-player games and multiplayer games differ. Hence, even if the focus was on competitive games because of their popularity, there are a bunch of other video games that are targeted at other audiences.

Although it looks like a good idea to make e-learning as addictive as online games, there is a high risk of borrowing negative aspects of competitive games too. In order to keep players engaged in education instead of video games, e-learning should not bring feelings like anxiety or aggression that players usually experience when they have a burnout from gaming and they have to do a temporary detox.

The data collection process also has its own limitations. While parsing the data from "pinger.kz" in order to identify the most popular games, we used the Apache toolkit and also gathered other data that turned out not to be significant. The questionnaire about the game preferences of students was provided by Google Forms, which is mainly considered insecure among the scientific community. Some of the data gathered from the questionnaire, like students' "steamid" or "MBTI-type" has not been used or analyzed. Also, one of the limitations is that the questionnaire was submitted by other students too. For instance, the questionnaire was submitted 102 times, but in the engagement analysis, there were only 73 students. "Power BI" shows the results of 76 students whose data is

present in the log file of their Moodle course and who submitted the questionnaire. Moreover, the questionnaire was offered to the students of the course for filling out on a voluntary basis. Hence, there might be biased results.

Moreover, the analysis of students' engagement by their game preferences did not show the results as expected. The results turned out to be not clear enough to make conclusions explicitly. For example, the experiment did not consider the students' performance, which is valuable information for future research. Therefore, the suggestions made during the discussion of the results may not have sufficient scientific evidence.

Unfortunately, the study did not provide practical experience by applying gamification methods in the process of e-learning explicitly. The paper is mainly intended to gather all the needed data, while the next step is to build gamification methods and test them on students.

These limitations of the study should be taken into account in future research. The field of gamification in education based on game preferences needs further research.

5. Conclusion

In this dissertation, the researchers intend to propose gamification methods as a possible solution for motivating and engaging students during e-learning. The dissertation's main goal was to propose possible solutions by gathering corresponding data, so the emphasis was on the local data.

There were supplied the results, which other researchers in this subject can examine. Our literature study will assist new gamification researchers in gaining an overview of the topic and identifying existing gamification strategies. In the review, the ideal way for developing gamification approaches is identified as a user-centered approach to development.

The findings of the studies carried out during the study revealed the students' gaming preferences. The most popular online video games among Kazakh teenagers were identified as "CS:GO," "Dota2," "PUBG," and "FIFA," and gamification strategies based on these findings were addressed. It was identified that the fields of cybersport and gaming overall are prospective and will develop in the future. This means that educational systems must adapt to this trend.

However, the results did not reveal any significant differences between the student groups, as expected. The results are shown in the analysis, but due to their limitations, interpreting them may be difficult. The suggestions were described in the discussion section.

Researchers using a similar approach may find the study's findings useful. Students' favorite games can be used to build gamification strategies. Games use mechanisms to entice a large number of individuals into addiction, allowing them to become extremely successful. When it came to online learning, students lacked interest and motivation to study, but online video games were able to draw them in far more effectively. These mechanics can also be used in e-learning to make learning as enjoyable as playing online games.

A. Appendix A

Question	Options
Student ID	-
Your MBTI type (optional)	Architect INTJ-A / INTJ-T Logician INTP-A / INTP-T Commander ENTJ-A / ENTJ-T Debater ENTP-A / ENTP-T Advocate INFJ-A / INFJ-T Mediator INFP-A / INFP-T Protagonist ENFJ-A / ENFJ-T Campaigner ENFP-A / ENFP-T Logistician ISTJ-A / ISTJ-T Defender ISFJ-A / ISFJ-T. Executive ESTJ-A / ESTJ-T Consul ESFJ-A / ESFJ-T Virtuoso ISTP-A / ISTP-T Adventurer ISFP-A / ISFP-T Entrepreneur ESTP-A / ESTP-T Entertainer ESFP-A / ESFP-T
Steam ID or steam profile url (optional)	-
Do you play videogames?	Yes I used to play, but now don't No, I have never played videogames
How often do you play videogames?	Never less than 1 hour a week 1 to 3 hours a week less than 1 hour a day 1 to 3 hours a day 3 hours a day and more
Choose up to 3 games that exemplify the type of competitive online games you like	CS:GO PUBG Dota 2 FIFA StarCraft Clash Royale PES Mobile Legends Rainbow Six Tekken Auto Chess Brawl Stars Valorant Fortnite Mortal Kombat Garena Free fire Call of Duty UFC Hearthstone Rocket League
Pick the game that exemplify the type of games you like	Counter Strike: Global Offensive (first-person tactical shooter) Dota2 (Action Real Time Strategy, MOBA) I really don't have any preferences

Table A.1: The questions of the questionnaire (Google Forms)

References

[1] *How covid-19 triggered the digital and e-commerce turning point.* Mar. 2021. URL: https://unctad.org/news/how-covid-19-triggered-digital-and-e-commerce-turning-point.

[2] Abdallah Moubayed et al. "Student engagement level in an e-learning environment: Clustering using K-means". en. In: *Am. J. Distance Educ.* 34.2 (Apr. 2020), pp. 137–156.

[3] N Fatonia et al. "University students online learning system during Covid-19 pandemic: Advantages, constraints and solutions"". In: *Systematic Reviews in Pharmacy* 11.7 (2020), pp. 570–576.

[4] Ashley M Fraser et al. "College students' media habits, concern for themselves and others, and mental health in the era of COVID-19". en. In: *Psychology of Popular Media* 11.2 (Apr. 2022), pp. 139–151.

[5] Sebastian Deterding et al. "From game design elements to gamefulness". In: *Proceedings of the 15th International Academic MindTrek Conference on Envisioning Future Media Environments - MindTrek '11.* New York, New York, USA: ACM Press, 2011.

[6] Jakub Swacha. "State of research on gamification in education: A bibliometric survey". en. In: *Educ. Sci. (Basel)* 11.2 (Feb. 2021), p. 69.

[7] *Digital media trends, 15th edition: Courting the consumer in a world of choice.* https://www2.deloitte.com/content/dam/Deloitte/br/Documents/technology-media-telecommunications/deloitte-digital-media-trends-15th-edition.pdf. (Accessed on 05/31/2022).

[8] Luz Ortiz et al. "Impact on the video game industry during the COVID-19 pandemic". In: *Athenea* 1 (Sept. 2020), pp. 5–13. DOI: 10.47460/athenea.v1i1.1.

[9] Mehmet Şener, Turkan Yalcin, and Osman Gulseven. "The Impact of COVID-19 on the Video Game Industry". In: *SSRN Electronic Journal* (Jan. 2021). DOI: 10.2139/ssrn.3766147.

[10] *Half-Life: Alyx Has Become Steam's Best & Most Rated VR Game.* https://www.roadtovr.com/half-life-alyx-steam-best-most-rated-game. (Accessed on 06/03/2022).

[11] *Teacher Gives Full Math Lesson in HALF-LIFE: ALYX - Nerdist.* https://nerdist.com/article/half-life-alyx-vr-math-lesson. (Accessed on 06/02/2022).

[12] Hannah R Marston and Rachel Kowert. "What role can videogames play in the COVID-19 pandemic?" In: *Emerald Open Research* 2 (2020).

[13] Darren Turnbull, Ritesh Chugh, and Jo Luck. "Transitioning to E-Learning during the COVID-19 pandemic: How have Higher Education Institutions responded to the challenge?" In: *Education and Information Technologies* 26.5 (2021), pp. 6401–6419.

[14] Zamzami Zainuddin et al. "The impact of gamification on learning and instruction: A systematic review of empirical evidence". en. In: *Educ. Res. Rev.* 30.100326 (June 2020), p. 100326.

[15] *e-learning noun - Definition, pictures, pronunciation and usage notes | Oxford Advanced Learner's Dictionary at OxfordLearnersDictionaries.com.* https://www.oxfordlearnersdictionaries.com/definition/english/e-learning. (Accessed on 05/31/2022).

[16] Madeline Will. "Most educators require kids to turn cameras on in virtual class, despite equity concerns". en. In: *Educ. Week* (Oct. 2020).

[17] Ainur Seilkhan et al. "Problems of distance education in Kazakhstan during the COVID-19 pandemic". In: *World J. Educ. Technol. Curr. Issues* 14.2 (Mar. 2022), pp. 380–389.

[18] Michał Bączek et al. "Students' perception of online learning during the COVID-19 pandemic: A survey study of Polish medical students". en. In: *Medicine (Baltimore)* 100.7 (Feb. 2021), e24821.

[19] M Alimanova and B Karazhan. "The Lack of Gamification Methods in E-Learning"". In: *Proceedings of International Young Scholars Workshop* 10 (2021), pp. 395–406.

[20] Paul Nicholson. "A history of E-learning". In: *Computers and Education*. Dordrecht: Springer Netherlands, 2007, pp. 1–11.

[21] Batool M Amarneh et al. "The impact of COVID-19 on E-learning: Advantages and challenges". In: *Proceedings of the International Conference on Artificial Intelligence and Computer Vision (AICV2021)*. Advances in intelligent systems and computing. Cham: Springer International Publishing, 2021, pp. 75–89.

[22] Qurotul Aini et al. "Exploring E-learning challenges during the global COVID-19 pandemic: A review". In: *J. Sist. Inf.* 16.2 (Oct. 2020), pp. 57–65.

[23] Kamal Kant and Shilpa Parihar. "E-learning opportunities & Challenges for learners of modern era". en. In: *SSRN Electron. J.* (2021).

[24] Lidia Aguiar-Castillo et al. "Gamification and deep learning approaches in higher education". en. In: *J. Hosp. Leis. Sport Tour. Educ.* 29.100290 (Nov. 2021), p. 100290.

[25] Ann-Kathrin Rahm et al. "Effects of realistic e-learning cases on students' learning motivation during COVID-19". en. In: *PLoS One* 16.4 (Apr. 2021), e0249425.

[26] Tomislav Rozman and Liliana Donath. "The current state of the gamification in E-learning". In: *Mednar. inov. posl.* 11.3 (Dec. 2019), pp. 5–19.

[27] Gene Klein. "Viewing gamification design limitations and weaknesses through a pandemic lens". en. In: *Societies (Basel)* 11.4 (Nov. 2021), p. 137.

[28] Renata Pereira Oliveira et al. "Gamification in E-learning and sustainability: A theoretical framework". en. In: *Sustainability* 13.21 (Oct. 2021), p. 11945.

[29] Awaz Naaman Saleem, Narmin Mohammed Noori, and Fezile Ozdamli. "Gamification applications in E-learning: A literature review". en. In: *Technol. Knowl. Learn.* 27.1 (Mar. 2022), pp. 139–159.

[30] J Majuri, J Koivisto, and J Hamari. *Gamification of Education and Learning: A Review of Empirical Literature*. 2018.

[31] Ana Manzano-León et al. "Between level up and game over: A systematic literature review of gamification in education". en. In: *Sustainability* 13.4 (Feb. 2021), p. 2247.

[32] Ana Carolina Tomé Klock et al. "Tailored gamification: A review of literature". en. In: *Int. J. Hum. Comput. Stud.* 144.102495 (Dec. 2020), p. 102495.

[33] Juho Hamari and Janne Tuunanen. "Player types: A meta-synthesis". In: *Trans. Digit. Games Res. Assoc.* 1.2 (Mar. 2014).

[34] A Breugelmans. *Examining National and Cultural Differences in Game Preferences.* 2018.

[35] *SteamDB.* `https://steamdb.info/`. (Accessed on 05/31/2022).

[36] Bohyun Kim. *Understanding gamification.* ALA TechSource Chicago, 2015.

[37] Team G Style. *Cybersport as a new direction of development for teenagers – G Style Magazine.* `https://gstylemag.com/2020/08/20/cybersport-as-a-new-direction-of-development-for-teenagers/`. (Accessed on 05/31/2022). Aug. 2020.

[38] Christina Gough. • *Global eSports market revenue 2024 | Statista.* `https://www.statista.com/statistics/490522/global-esports-market-revenue/`. (Accessed on 05/31/2022). Apr. 2022.

[39] КН Мысаева et al. "Esport in journalism: commentator Of esport as a modern profession". In: *Серия Журналистики* 54.4 (2019), pp. 77–85.

[40] *Pinger.Pro – Киберспортивная турнирная платформа. Игры, Новости, Соревнования.* `https://pinger.kz/`. (Accessed on 05/31/2022).

[41] *Qazaq CyberSport Federation.* `https://qcf.kz/ru/statistics`. (Accessed on 05/31/2022).

[42] Gustavo F Tondello and Lennart E Nacke. "Player characteristics and video game preferences". In: *Proceedings of the Annual Symposium on Computer-Human Interaction in Play.* Barcelona Spain: ACM, Oct. 2019.

[43] *Free personality test, type descriptions, relationship and career advice | 16Personalities.* `https://www.16personalities.com/`. (Accessed on 05/31/2022).

[44] *Logs - MoodleDocs.* https://docs.moodle.org/400/en/Logs. (Accessed on 05/31/2022).

[45] **M Dewan, Mahbub Murshed, and Fuhua Lin.** "Engagement detection in online learning: a review". In: *Smart Learning Environments* 6.1 (2019), pp. 1–20.

[46] **Chanut Poondej and Thanita Lerdpornkulrat.** "Gamification in e-learning: A Moodle implementation and its effect on student engagement and performance". In: *Interactive Technology and Smart Education* (2019).

[47] *Counter-Strike: Global Offensive (App 730) · Steam Charts · SteamDB.* https://steamdb.info/app/730/graphs/. (Accessed on 06/08/2022).