Effects of Playing Video Games on Students' Selection Test Results to Enter Nazarbayev Intellectual schools

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Submitted in partial fulfilment of the requirements for the degree of

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in
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September 2021

September 21, 2021

Dear Aigul Jandarova

This letter now confirms that your research project entitled: "Effects of playing video games on students' selection test results to enter Nazarbayev Intellectual schools" has been approved by the Graduate School of Education Ethics Committee of Nazarbayev University.

You may proceed with contacting your preferred research site and commencing your data analysis.

Yours sincerely

Kathy Lea Malone

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Abstract

Effects of Playing Video Games on Students' Selection Test Results to Enter Nazarbayev Intellectual schools

These days children spend a lot of time playing a variety of video games, created for different ages, devices and preferences. This makes their parents worry about their academic achievements, especially if they plan to compete for placement in a selective school. To address this issue the present study aimed to determine whether playing video games affected students' performance in high-stake standardised entrance tests. For this purpose, 255 students' self-reported video game behaviour and their selection test results to enter Grade 7 of Nazarbayev Intellectual schools were analysed making use of multiple regression modelling. Students' video gaming behaviour were represented by their favourite video game, genre and their playing habits during weekdays and weekends. NIS selection test results included the students' scores in 7 academic domains - Mathematics, Quantitative Reasoning, Kazakh as the first and second, Russian as the first and second, and English languages. The present study established significant positive effects of playing video games of Sandbox, Strategy and Simulation genres on Mathematics and Quantitative Reasoning scores, Strategy genres on Kazakh as the first language, Action and Sports genres on Russian as the first language. A significant negative association was also found between playing games during weekdays and Mathematics, Quantitative Reasoning, and Language tests for students with Russian as the first language as well as significant positive effect between these subjects and playing during weekends. These findings suggest that playing video games of specific genres may enhance students' complex cognitive abilities, for instance spatial reasoning skills, computational thinking, problem-solving skills, as well as provide necessary relaxation and motivation for further studying. These scientific research findings enrich existing literature on the influence of playing video games on students' performance

in high-stake standardised tests and contribute to the knowledge of interested stakeholders, especially parents, teachers, psychologists and students.

Абстракт

Бейнеойындардың Назарбаев Зияткерлік мектептеріне түсу үшін оқушыларды іріктеу тестінің нәтижелеріне әсері

Қазіргі таңда балалар әртүрлі жас ерекшелігіне, құрылғы түрі мен ойыншы қалауына арналған түрлі бейнеойындарды ойнауға көп уақыт жұмсайды. Бұл жағдай ата-аналарды балаларының академиялық үлгеріміне қатысты алаңдатады, әсіресе мамандандырылған мектепке түсу конкурсына қатысуды жоспарлап жүрген балалардың ата-аналары үшін басты мәселе болып табылады. Аталған мәселені негізге ала отырып, бұл зерттеу жұмысы стандартталған жоғары деңгейлі түсу тестіндегі оқушылардың көрсеткіштеріне бейнеойындардың әсерін анықтауға бағытталған. Бұл бағытта бірнеше регрессиялық модельдеуді пайдалану арқылы Назарбаев Зияткерлік мектептерінің 7-сыныптарына түсу үшін іріктеу тестіне қатысқан 255 оқушының нәтижесі мен бейнеойын ойнау тәртібінің көрсеткіштеріне талдау жүргізілді. Оқушылардың бейнеойын ойнау тәртібінің көрсеткіштеріне сүйікті бейнеойынның атауы, бейнеойын жанры, жұмыс және демалыс күндеріндегі ойын ойнау әдеті кіреді. НЗМ-ге іріктеу тестінің нәтижелері 7 академиялық пән бойынша оқушылардың нәтижелерін қамтиды: математика, сандық сипаттамалар, қазақ тілі (бірінші және екінші тіл ретінде), орыс тілі (бірінші және екінші тіл ретінде) және ағылшын тілі. Зерттеу барысында «Құмсалғыш», «Стратегия» және «Симуляция» жанрындағы бейнеойындардың математика мен сандық сипаттамалар нәтижелеріне, «Стратегия» жанрындағы ойындардың қазақ тілі (бірінші тіл) нәтижелеріне, ал «Экшен», «Спорт» жанрындағы ойындардың орыс тілі (бірінші тіл) нәтижелеріне айтарлықтай оң әсер ететіні анықталды. Сондай-ақ жұмыс күндері ойналған ойындар мен математика, сандық сипаттамалар, орыс тілінде білім алатын оқушыларға арналған тілдік тесті арасында айтарлықтай теріс байланыс байқалады,

ал демалыс күндеріндегі ойындар бойынша аталған пәндердің нәтижелерінен айтарлықтай оң әсер көрінеді. Алынған нәтижелер белгілі бір жанрдағы бейнеойындардың оқушылардың күрделі танымдық қабілеттеріне әсер ететінін, атап айтқанда, кеңістіктік ойлау, оймен есептеу және проблемаларды шешу секілді дағдыларды дамытуға ықпал ететінін көрсетеді. Сонымен қатар бейнеойындар оқушылардың ойдағыдай демалуына, оқуға деген ынтасын арттыруына да негіз бола алады. Қарастырылып отырған ғылыми зерттеудің нәтижелері стандартталған жоғары деңгейлі түсу тесті бойынша бейнеойындардың оқушылардың көрсеткіштеріне әсері туралы ғылыми бағыттағы әдебиеттердің дамуына үлес қосып, мүдделі тараптардың – ата-ана, мұғалім, психолог пен оқушылардың білім деңгейін арттыруға ықпал етеді.

Абстракт

Влияние видеоигр на результаты отборочного теста учащихся по поступлению в Назарбаев Интеллектуальные школы

В настоящее время дети проводят много времени, играя в разнообразные видеоигры, созданные для разных возрастов, устройств и предпочтений. Данное явление заставляет родителей беспокоиться об академической успеваемости своих детей, особенно если они планируют участвовать в конкурсе на поступление в специализированную школу. Принимая во внимание данную проблему, настоящее исследование направлено на определение влияния видеоигр на показатели учащихся в стандартизированных вступительных тестах с высокими ставками. С этой целью путем использования множественного регрессионного моделирования был проведен анализ показателей поведения 255 учащихся в видеоиграх с их результатами отборочного теста по поступлению в 7 классы Назарбаев Интеллектуальных школ. Показатели поведения учащихся в видеоиграх включают наименование любимой видеоигры, жанра видеоигры, а также игровые привычки в будние и выходные дни. Результаты отборочного теста в НИШ включают результаты учащихся по 7 академическим предметам: математика, количественные характеристики, казахский как первый и второй язык, русский как первый и второй язык, а также английский язык. Настоящее исследование установило значительное положительное влияние видеоигр жанров “Песочница”, “Стратегия” и “Симуляция” на результаты по математике и количественным характеристикам, игр жанра “Стратегия” на результаты по казахскому как первому языку, игр жанра “Экшен” и “Спорт” на результаты по русскому как первому языку. Также была обнаружена значительная отрицательная взаимосвязь между играми в будние дни и математикой, количественными характеристиками и языковым тестом для учащихся с русским как

первым языком, а также значительный положительный эффект на результаты данных предметов от игр в выходные дни. Данные результаты свидетельствуют о том, что видеоигры определенных жанров могут влиять на сложные когнитивные способности учащихся, развивая навыки пространственного мышления, вычислительное мышление, навыки решения проблем. Также видеоигры могут обеспечить учащимся необходимый отдых и мотивацию для дальнейшего обучения. Результаты данного научного исследования вносят определенный вклад в научную литературу о влиянии видеоигр на показатели учащихся в стандартизированных тестах с высокими ставками, а также способствуют повышению уровня знаний заинтересованных сторон, т.е. родителей, учителей, психологов и учащихся.

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Effects of Playing Video Games on Students' Selection Test Results to Enter Nazarbayev Intellectual schools

Introduction

With the rapid digital advancements, children have an opportunity to experience not only conventional outdoor and indoor games but also sophisticated video games designed for various preferences. The ongoing development of the video game industry produces more and more realistic, engaging, and adventurous games, which capture children's attention and time. Over the past 30 years, the video game industry appears to have become one of the biggest entertainment industries in the globe, forecasting a $138 billion income in 2021 on a global scale (Statista, 2021). According to the authoritative sources, there are about 2.5 billion gamers around the world (Yanev, 2021), out of which nearly 75 million are American children (76%) under 18 years old (ESA, 2021), including 80% of Kazakhstani children aged 12-13 years old (Baigarin, 2013). This, in turn, has created some level of public alarm as people recognize this as a possible threat to the academic, physical, and emotional development of children during their foundational years.

Consequently, many researchers began to study the influence of video gaming on children's academic achievements (e.g., Anderson & Dill, 2000; Cummings & Vanderwater, 2009; Drummond & Sauer, 2014; Gentile, 2011; Granic et al., 2014; Skoric et al., 2009; Wittwer & Senkbeil, 2008). The results of these studies are controversial and they have discovered zero, negative, or positive effects on students' scholastic achievements (e.g., Bowers & Berland, 2013; Drummond, & Sauer, 2014; Ferguson, 2011; Terry & Malik, 2018). Nevertheless, such studies appear to be very much dependent on the time spent playing video games, and the game genres themselves (e.g., Adachi & Willoughby, 2013; Islam et al., 2020; Terry & Malik, 2018).

Therefore, considering the proposed effects of video gaming on students' academic performance, it is now worth to examine the relationship between playing video games and students' performance in a standardised selection assessment. Specifically, this study explored the effects of specific video game genres and playing on weekdays and weekends on the students' performance in the standardised entry exams to Grade seven of Nazarbayev Intellectual schools in Kazakhstan. The results of this research can inform parents about the possible positive and negative academic implications of allowing their children to play video games before undertaking high-stakes standardised examinations.

Background of the Study

Nazarbayev Intellectual schools

Nazarbayev Intellectual Schools (NISs) are considered to be one of the most prestigious secondary educational networks in Kazakhstan. The first school was opened in 2008 and now 21 schools have been functioning in 17 cities of the country. These schools include 10 schools of Physics and Mathematics, 10 of Chemistry and Biology, which follow the NIS-Programme developed together with NIS's strategic partner, Cambridge International Examinations, in compliance with the international standard (A-level). One school offers the International Baccalaureate programme. At the same time, two NISs are admitting students to Grades 1-12 while the remaining 19 schools enrol students in Grades 7-12 in Kazakh and Russian classes (Autonomous Educational Organization "Nazarbayev Intellectual Schools" 2030 Development Strategy, 2018).

Admission to NISs Grade seven is conducted every year usually in March-May for Grade six students who are 12-14 years old. Competition to enter NIS Grade seven is quite high because studying is free based on an educational grant "Orken", which covers all students' expenses like housing in dorms, learning materials, uniforms, participation in

national and international competitions, etc. (The Government of the Republic of Kazakhstan, 2009).

The selection test consists of five subtests: Mathematics, Quantitative Reasoning (ability test), Kazakh, Russian and English languages. Applicants indicate Kazakh or Russian language as their preferred language of instruction. Therefore, students with the Kazakh language of instruction are given Kazakh as the first language, Russian as the second language, and English language tests, conversely, students with the Russian language of instruction are given Russian as the first language, Kazakh as the second language, and English language tests. Therefore, overall the NIS selection test includes seven subtests. Hereinafter, students admitted to classes with Kazakh or Russian mode of instruction study according to NIS-Programme which are the same for Kazakh and Russian classes.

Candidates' selection test answers are analysed psychometrically using Classical Test Theory and Item Response Model. In order to be considered for the grant, students have to achieve threshold scores in Mathematics and Quantitative Reasoning. Those students, who received passing scores, are ranked based on their total test scores on five subtests from the top-performing to the lowest-performing students. Consequently, students with the highest total scores are selected depending on the number of available vacant places per language of instruction per school (Government of the Republic of Kazakhstan, 2009).

Students' training and free time

Taking into account the high-stakes nature of the NISs selection test, many parents try to start preparing their children for the entrance examination one-two year earlier (Kalmurat, 2020). In order to enhance their chances to be admitted to NIS parents arrange additional classes in private educational centres, purchase practice test booklets, and

register their children to additional educational services provided by NIS like Virtual and Vocational schools, online courses, and trial tests.

In the meantime, parents also try to organise qualitative rest for their children from their constant studies and feel anxious seeing their children playing video games (Lieberoth & Fiskaali, 2020). Apparently, playing video games has become one of the most popular pastimes for children, especially for the age group of the NIS applicants (Gentile, 2011; Rideout et al., 2010). These students are able to search, download, understand the instructions and play various video games. Considering children's natural curiosity and excitement, in a majority of cases, they are not able to regulate themselves nor limit the amount of time spent playing video games (WHO, 2018). As a result, excessive playing leads to forming an addiction to video gaming, which in turn can negatively influence their physical, mental, and social abilities as well as academic performance (Cummings & Vandewater, 2007; Johnson & Edwards, 2020).

The Committee for the Protection of Children's Rights of the Ministry of Education and Science in Kazakhstan conducted research that revealed that approximately 1500 children and adolescents visit computer clubs, which provide paid access to the Internet and video games, near their homes, educational institutions, and shopping malls. Minors spend an average of two to four hours in front of a computer screen per visit, while according to sanitary standards, a child of primary school age should spend no more than 20 minutes a day at the computer. The data of this research showed that 80% of schoolchildren aged 12-13 suffered from computer addiction in Kazakhstan (Baigarin, 2013).

On the contrary, some researchers state that children start playing video games due to such factors as the joy of competition, the opportunity to teach and lead co-players, the ability to discover and feed their interests, as well as for relaxation, generation of a positive

mood, and coping with anger (Olson, 2010). These findings concur with the results of the Entertainment Software Association's latest survey of 4 000 18 years old and older Americans, answering questions about their video game preferences: 90% of them played for enjoyment, 87% - to get mental stimulation, 87% - to relieve the stress, 81% - to improve collaborative skills, 79% - to become inspired (ESA, 2021). Moreover, 71% of parents agreed that video gaming provided a necessary break for their children and 66% of parents believed that video gaming facilitated shifts to online learning (ESA, 2021).

A growing body of literature has examined the effect of video games on children's academic achievement in light of the game genres and frequency of playing video games (Adachi & Willoughby, 2013; Islam et al., 2020; Terry & Malik, 2018). Massive video game companies have developed numerous kinds of video games in the pursuit of meeting the interests and preferences of children and subsequently increasing the number of users as well as their own financial income. As a result, there are different video game genres – action-adventure, fighting, role-playing, puzzle, strategy, shooter, etc. (Apperley, 2006; Ventura et al., 2012). Consequently, scholars in the field began studying the effect of video games on students' academic achievements in terms of the influence of preferable game genres, playing time, or days (weekdays and weekends), which revealed both inconclusive and contradictory results, reporting a range of positive, negative and negligible effects (Apperley, 2006; Dindar, 2018; Islam et al., 2020; Sharif & Sargent, 2006; Skoric et al., 2009; Ventura et al., 2012).

However, there has been little discussion about the effect of playing video games on students' standardised gifted school admission test results. Due to a general lack of related studies in this specific area, and existing controversy in the results of implemented research, which established both positive, negative, and zero effects of playing video games on academic performance, it can be assumed that the effects of video games on

academic performance remain unclear for the interested parties in the world and Kazakhstan. Therefore, an investigation of this issue in the Kazakhstani context makes a worthy contribution and fills an existing gap in the body of scientific knowledge and parents' awareness of the effect of recreational video gaming on students' performance in high-stakes admission testing.

Statement of the Problem

The aim of this research was to examine the effect of playing video games on students' NIS selection test performance for entrance into Grade seven for the 2021-2022 academic year.

The study used students' responses to demographic questions designed to measure their video gaming habits, preferences, hours of playing on weekdays and weekends as well as their performance on seven academic subtests, obtained directly from the NIS selection test centre. Students' responses to the video gaming questions were employed as independent variables. The dependent variables included students' results on the NIS selection test subtests: Mathematics, Quantitative Reasoning, Kazakh as the first and second languages, Russian as the first and second languages, and English language.

Purpose of the Study and Research Questions

The purpose of this quantitative study was to identify the influence of playing video games by Grade six students on their NIS selection test results. The results of this research determined the influence of students' video gaming on their academic achievements, in terms of performance in high-stake standardised test in the Kazakhstani context.

The study aimed to address the following research questions and test the following null hypotheses:

RQ1: What video games and video game genres were the most popular for the sample of students during the months leading up to the NIS selection test?

Hypothesis 1: There were no popular video games and video game genres for the sample of students during the months leading up to the NIS selection test.

RQ2: How does the performance for each subject of the NIS selection test compare between the sample and the population of students?

Hypothesis 2: There is no difference between the performance of the sample and the population of students for each subject of the NIS selection test.

RQ3: What effect does the students' video gaming behaviour have on their NIS selection test results for the sample?

Hypothesis 3: Students' video gaming behaviour does not affect their performance on the NIS selection test.

Significance of the Study

Children's elevated engagement in video gaming has been attracting an increasing interest due to the fast-emerging pace of the electronic gaming industry and incomparably slow progress of education at the same time (Goldin & Katz, 2010). Other factors, namely, increasing the financial well-being of the population, advancements, and affordability of electronic devices, and homeschooling during Covid-19 quarantine have worsened the situation by creating excellent conditions for children's active video gaming (ESA, 2021; Yanev, 2021). Finally, the fact that the World Health Organization (WHO, 2018) included gaming disorder in the International Classification of Diseases in 2018 makes this area of research substantially significant.

Despite this topicality, there has been little discussion about the influence of playing video games on the results of standardised admission tests to specialised secondary schools. Most studies in the field have only focused on identifying the effect of video gaming on students' school grades, self-evaluation of their own academic performance, results of standardised assessments, particularly, PISA, intelligent tests, the National

Assessment Programme - Literacy and Numeracy, and the Wide Range Achievement Test (Drummond & Sauer, 2014; Gentile, 2011; Islam et al., 2020; Jackson et al., 2011; Rehbein et al., 2010; Van Schie & Wiegman, 1997; Willoughby, 2008). Therefore, the findings of this study contribute to a better understanding of video gaming implications on the results of standardised entrance tests for Grade six students and rectify the gap in the relevant literature.

Moreover, the results of this research may bring valuable information about the proper use of recreational video games by the students, who experience rough times preparing themselves to compete for a placement in selective schools like NISs. Since other well-known schools in multiple countries also practice student selection, the issue of playing digital games by candidates is vital for all interested stakeholders.

Furthermore, the outcomes of the present study are of interest to policymakers of Kazakhstan, responsible for the update of existing policies, which regulate children's hygienic video gaming. A notable example of such policy adjustments would be the recent restrictions on the amount of time for playing video games by students, which were undertaken in November 2019 in China. According to this law, students are permitted to play for a total of three hours on Friday, Saturday, and Sunday only (Video games in China, 2021). Venezuela, Brazil, Japan, South Korea, Australia, New Zealand, Malaysia, Singapore, Germany, United Kingdom, Saudi Arabia, United Arab Emirates, Iran, as well as Pakistan has also banned or censored video games with excessive violence, sexual content, drugs, as well as games, which threaten the social order, public security and religious views (15 countries that ban video games, 2016). To the best of our knowledge, there is no explicit legislation, which regulates video gaming practices among Kazakhstani children.

Conclusion

This paper contains six chapters, each of them consisting of several sections. The first chapter provided comprehensive introductory information about the context of the identified problem, focus, and objectives of the study. This chapter provides information about the historical context, findings of the studied area, the place, and significance of the present paper within the broader picture.

The second chapter analysed the key literature relevant to the research topic, which justified the focus of the research. This also generates the reader's topic knowledge about what is already known, what is unknown, and what has been questioned by the experts in the field. This information helps the reader to understand the originality of the present research topic, and its contribution to the existing body of knowledge.

In the third section, a detailed methodology was presented in order to justify to the reader the rationale and assumptions, which underpin the approach to this quantitative research. The chapter explained thoroughly the data collection instruments, procedures, analysis methods, and compliance to ethical norms.

The fourth chapter presented the results of the statistical analysis, conducted to test null hypotheses to three research questions. The chapter contains tables with quantitative analysis outcomes with an indication of statistical relationships between the variables.

The fifth chapter assessed the importance and discussed the findings of the quantitative analysis in relation to the reviewed literature.

The last and sixth chapter summaries the study, indicating the main findings of the research, its limitations, theoretical and practical implications as well as recommendations to the interested stakeholders.

Literature Review

Introduction

The purpose of this quantitative study was to identify the influence of playing video games on the performance in the standardised NIS selection test of grade six students in Kazakhstan. The study is guided by the following research questions:

RQ1: What video games and video game genres were the most popular for the sample of students during the months leading up to the NIS selection test?

RQ2: How does the performance for each subject of the NIS selection test compare between the sample and the population of students?

RQ3: What effect does the student's video gaming behaviour have on their NIS selection test results for the sample?

This chapter analyzes and synthesises the key available literature, which establishes the conceptual framework for the examination of the influence of video games on students' results on the NIS selection test. For a better understanding of the problem, the chapter starts with an overview of video game development, and specifying the existing genres of video games. The next section provides information about the influence of video gaming on children's cognitive development with an emphasis on their academic progress. The last three sections share the findings of relevant studies, which identified positive, negative, and zero effects of video gaming on students' academic performance.

Video Games and their Genres

Presently, recreational video gaming monopolises the current young generation, since video games have become affordable, omnifarious, entertaining fast, and provided many opportunities for socialising and creating communities with other gamers. Wikipedia

provides a simple technical definition - “a video game or a computer game is an electronic game that involves interaction with a user interface or input device – such as a joystick, controller, keyboard, or motion-sensing device – to generate visual feedback.” (Video game, 2021). Additionally, experts in the field provide a variety of definitions as well. Skoric et al. (2009) defined certain features of video games stating that they differ from traditional games by providing an interactive and mediated environment, the possibility to send and receive messages between players, the ability to shift roles between streamer and player, and the ability for players to experience miscellaneous virtual worlds, accumulate points, heal and customise their avatars, and choose equipment. Green and Seitz (2015) provided a comprehensive description of a video game:

> The term video games refers to thousands of quite disparate types of experiences, anything from simple computerized card games to richly detailed and realistic fantasy worlds, from a purely solitary activity to an activity including hundreds of others, from a strictly antagonistic/competitive experience to a strictly friendly/pro-social experience, from nothing more than a simple set of rules to a full and highly immersive fiction. (Green & Seitz, 2015, p. 102)

However, the nature and definition of video games will most likely change, expand and evolve without ever stopping. Such predictions are suggested because it was over 50 years ago that the first video game Spacewar! was released, which differs enormously from contemporary video games (Egenfeldt-Nielsen et al., 2012). It is noteworthy that Spacewar! was not the first video game ever developed, but it became the first user-friendly video game for use on a personal computer, which became successful and marked the beginning of the gradual development of the video game industry (Egenfeldt-Nielsen et al., 2012).

Consequently, a great number of video games have been released up to the present day and continue to appear on the digital games market. Currently, these video games can be played on different platforms, e.g., game consoles (e.g., Sony PlayStation, Sega, Nintendo GameCube, Microsoft Xbox, and Oculus VR), personal computers, laptops, tablets, and mobile phones. These platforms have different technical realisation (software) and, therefore, offer diverse levels of game specifications, mainly, graphics, interactivity, sound, player mode, communication, and gaming experience for players (Apperley, 2006; Brand et al., 2003).

Similar to music and film, video games have a wide variety of genres, which reflect useful general information about the style, narrative, and mode of the game (Apperley, 2006). Video game genres continue to expand in their variety, becoming more and more complicated and multifarious. Therefore, it is better to refer to popular online websites when looking for the most up-to-date list of video game genres, because such platforms are flexible and fast-responding to the releases of new products on the video gaming market. In this regard, Wikipedia is the best example, as it provides the widest list of video game genres, which includes 12 main genres with three to 14 subgenres in each main genre (see Figure 1) (List of video game genres, 2022).

Figure 1

List of Video Game Genres from Wikipedia

1 Action
- 1.1 Platform games
- 1.2 Shooter games
- 1.3 Fighting games
- 1.4 Beat 'em up games
- 1.5 Stealth game
- 1.6 Survival games
- 1.7 Rhythm games
- 1.8 Battle Royale games

2 Action-adventure
- 2.1 Survival horror
- 2.2 Metroidvania

3 Adventure
- 3.1 Text adventures
- 3.2 Graphic adventures
- 3.3 Visual novels
- 3.4 Interactive movie
- 3.5 Real-time 3D adventures

4 Puzzle
- 4.1 Breakout clone game
- 4.2 Logical game
  - 4.2.1 Physics game
  - 4.2.2 Coding game
- 4.3 Trial-and-error / exploration
- 4.4 Hidden object game
- 4.5 Reveal the picture game
- 4.6 Tile-matching game
- 4.7 Traditional puzzle game

5 Role-playing
- 5.1 Action RPG
- 5.2 MMORPG
- 5.3 Roguelikes
- 5.4 Tactical RPG
- 5.5 Sandbox RPG
- 5.6 First-person party-based RPG
- 5.7 JRPG
- 5.8 Monster Tamer

6 Simulation
- 6.1 Construction and management simulation
- 6.2 Life simulation
- 6.3 Vehicle simulation

7 Strategy
- 7.1 4X game
- 7.2 Artillery game
- 7.3 Auto battler (Auto chess)
- 7.4 Multiplayer online battle arena (MOBA)
- 7.5 Real-time strategy (RTS)
- 7.6 Real-time tactics (RTT)
- 7.7 Tower defense
- 7.8 Turn-based strategy (TBS)
- 7.9 Turn-based tactics (TBT)
- 7.10 Wargame
- 7.11 Grand strategy wargame

8 Sports
- 8.1 Racing
- 8.2 Sports game
- 8.3 Competitive
- 8.4 Sports-based fighting

9 MMO

10 Other notable genres
- 10.1 Board game or card game
- 10.2 Casino game
- 10.3 Casual games
- 10.4 Digital collectible card game
- 10.5 Gacha game
- 10.6 Horror game
- 10.7 Idle game
- 10.8 Logic game
- 10.9 Party game
- 10.10 Photography game
- 10.11 Programming game
- 10.12 Social deduction game
- 10.13 Trivia game
- 10.14 Typing game

11 Video game genres by purpose
11.1 Advergame
11.2 Art game
11.3 Casual game
11.4 Christian game
11.5 Educational game
11.6 Esports
11.7 Exergame
11.8 Personalized game
11.9 Serious game
12 Sandbox / open world games
12.1 Sandbox
12.2 Creative
12.3 Open world

(List of video game genres, 2022)

Such a great variety of video game genres indicates the games' diversity, different virtual worlds, numerous characters and avatars, varied levels of mechanics, and interaction with game objects. For example, Action video games have elaborate 3D environments, where objects can appear and escape quickly among other distracting subjects making real-life sounds of running, jumping, and crawling. Action video games "require the player to consistently switch between highly focused and highly distributed attention, and that require the player to make rapid, but accurate decisions" (Green & Seitz, 2015, p. 102). Strategy video game genre is less action-oriented but necessitates players' thorough and smart thinking in order to defeat an opponent player or team, which can vary from a squad to an army with various skillful warriors (List of video game genres, 2022). Another interesting video game genre is Simulation, which has three main game types not similar to each other at first sight. The first subgenre, Construction and management simulation, requires players to develop his/her fictitious communities or projects by trading, exchanging goods, and accumulating game currency, thus managing and leading them to prosperity. In the second subgenre, Life simulation, players simulate the living of another human or animal being, interacting with the objects of the virtual world, evolving

under certain conditions without the necessity to complete any special missions and targets. In the third subgenre, Vehicle simulation, gamers navigate with various kinds of vehicles, like racing cars, helicopters, aeroplanes, spacecrafts, etc. in different virtual worlds (List of video game genres, 2022). There is even a video game genre called Social deduction games, which is similar to Mafia games, where players have to determine each other's hidden roles using didactics and logic.

As a result, contrary to popular utterance, video games do not represent only violent games. There are a number of video games, which require players' critical thinking, evaluation of risks, predicting actions of co-players and foes, and many other cognitive activities. Considering the different narrative contexts of video games, experts in the field suggested researching the effects of video game genres on players' cognitive and behavioural aspects (Brand et al., 2003; Ventura et al., 2012). The next section analyses the findings of related literature on the effect of playing video games on children's cognitive development.

Video Games Effect on Children's Cognitive Development

Researchers started to investigate the implications of adolescents' engagement in video games on their lives and development, since the fact that "each hour a child spends playing entertainment games is an hour not spent on homework, reading, exploring, creating, or other things" (Gentile, 2011, p. 76).

As a result, there is a vast amount of literature on the effect of playing video games on children's development both from scholarly audiences and digital game associations. Most of them examined its effect on the cognitive domain of youth development, some provided findings on their influence on children's mental, social, emotional, motivational, and health domains of development. Whereas all these aspects of development are crucial in the discussion of a child's healthy growth, this section provides the findings of key

literature specifically on the effect of video gaming on children's cognitive domain development since this is the most influential factor of students' academic performance. Also, particular attention is paid to the effects playing violent games' have on children's development, possibly being the most controversial topic in terms of its possible positive and negative effects on children's healthy development.

A thorough review of the literature found that some video games had a significant positive impact on children's cognitive development, particularly on the improvement of spatial reasoning skills, mental rotation abilities, visual and aural attentional capacities, computational thinking, memory capacity, problem-solving skills, and creativity (Berland & Lee, 2011; Brown, 2014; Egenfeldt-Nielsen et al., 2012; Gentile, 2011; Granic et al., 2014; Jackson et al., 2012; Kowal et al., 2018; Lin et al., 2013; Schmidt & Vandewater, 2008). Also, it was found that players who spent more time on video gaming had better results in cognitive tests on assessing the ability to shift or focus their attention and on the speed of visual search and track of changes (Kowal et al., 2018).

Spatial reasoning skills and mental rotation abilities were enhanced through learning to navigate, find desired places, ways, and objects, locate friends and foes in virtual worlds of almost all game genres (Cherney, 2008; Granic et al., 2014; Green & Bavelier, 2012). It was found that enhanced spatial reasoning skills were strong predictors of performance in science, technology, engineering, and mathematics (STEM) through conducting a longitudinal study of 400 000 American students in Grade 9-12 on the basis of their initial spatial reasoning levels, then GPA results, and further career choices over 11+ years period of time (Wai et al., 2009).

Visual and aural attentional capacities are best developed in action video games, since players have to attentively scan the screen and listen to unusual sounds to quickly locate and defend against an enemy, which can appear and attack from anywhere (Bavelier

et al., 2012; Gentile, 2011; Granic et al., 2014). Computational thinking and reasoning can be developed by playing strategic board games, which require players to internalise a set of rules and think up strategies to succeed in the game within those rules (Berland & Lee, 2011). The ability to memorise things, locations, weapons, skills, strategies, and numerous other gaming features is also developed during playing video games, especially Action video games (Green & Seitz, 2015).

Problem-solving skills have been found to be utilised in almost all video game genres, as gamers have to tackle various problems from the determination of the shortest way to the point of destination to identifying complicated operation series using recalling and reasoning abilities (Gee, 2005; Granic et al., 2014). Also, these skills were best developed in the so-called open-ended games, where players are deliberately not given clear instructions on possible solutions to game situations. Therefore, players overcame the challenges by examining all possible options based on their own existing expertise, reflection, and intuition (Granic et al., 2014). Often, young players who are experienced in playing such open-ended video games are considered a new generation of youth, referred to as “digital natives” (Prensky, 2012). In their longitudinal study of 1 492 Grade 9-12 students, Adachi and Willoughby (2013) demonstrated that playing strategic games had a positive effect on self-reported problem-solving skills the next year.

Increased creativity has been shown to be associated with playing any genre of video games in a study with approximately 500 12-year-old students (Jackson, 2012). Will Wright, a popular game designer, gave a clear explanation of how creativeness was increased due to playing games:

> As children, we spend much of our time in imaginary worlds, substituting toys and make-believe for the real surroundings that we are just beginning to explore and

understand. As we play, we learn. And as we grow, our play gets more complicated. We add rules and goals. (as cited in Brown, 2014, p. 11)

Much of the current literature on video gaming pays particular attention to games with violent content and their influence on children's cognitive development (Anderson et al., 2007; Gentile et al., 2004). As a result, several research have revealed that playing violent video games may increase aggressive cognition, and real-life antisocial behaviour, as well as cause desensitisation over both short and long term periods (Anderson et al., 2007; Anderson & Dill, 2000; Krahe & Moller, 2004; Slater et al., 2003).

However, some researchers have claimed that playing violent games may bring certain benefits, especially for males (Olson, 2010). Olson (2010) found that boys tend to select more masculine genres of video games, because there they receive an opportunity "to establish dominance and a social perking order, with no intention to harm" which is not allowed in the real world (p. 185). Thus, she suggested that "video game play could serve as another arena for the developmentally appropriate battle for status among peers" (Olson, 2010, p. 185). Olson argued that children's exposure to violent content at an appropriate level was a part of normal child growth since it "helps a child master the physical and emotional sensations that go with being afraid", and that was why almost every fairy tale has scary content like abandonment, fights, death, and destruction (Olson, 2010, p. 185).

Despite the large volume of scholarship on the positive influences of playing video games on children's cognitive development, very little is known about whether playing video games lead to the improvement of children's cognitive development, or whether children with enhanced cognitive abilities prefer to play certain types of video games (Granic et al., 2014).

Following the research connecting digital game playing to children's cognitive development, scientists began to conduct empirical studies to find any associations

between video gaming and students' academic achievements. Thus, the next three sections of the literature review chapter synthesise the findings of relevant studies on this issue.

Effects of Video Game Playing on Children's Academic Achievements

A considerable amount of literature has been published on the effects of playing digital games on students' academic performance in school and standardised assessments. These studies have shown contradictory results. The majority of studies have revealed that video gaming impacts students' scholastic achievement in a negative way, whereas a growing body of research has reported a positive and/or zero effect of playing video games on students' academic accomplishments.

Negative Effect of Playing Video Games on Children's Academic Achievements

The vast majority of research in this area has found that video games have a negative effect on students. One of the first studies exploring this issue was conducted by Anderson and Dill (2000), which established that time spent playing video games was associated with declining performance among students getting their bachelor's degrees. Following this previous work Anderson et al. (2007), in the results of a longitudinal study of 430 elementary students in Grades three-five, also found that the amount of video gaming time negatively affected school grades for those students who started playing at the beginning of an academic year. Later, Cummings and Vanderwater (2009) analysed 425 male and 109 female gamers between the ages of 10-19 years old and found that, on average, boys spent 30% and girls 34% less time on reading and homework for every hour of video gaming on weekdays, which may lead to diminished school performance. Similarly, a study of 1 495 university students in Thailand revealed that students who played for two hours daily usually had GPAs of 3.00 and below (Jaruratanasirikul et al., 2009). Furthermore, in their longitudinal correlational research of 482 12 years old African and Caucasian Americans, Jackson et al. (2011) determined that students with initial higher academic performance

and GPA were mostly affected negatively by excessive video gaming, whereas students with below average or average school grades and GPAs appeared not to suffer from frequent playing over a one-year time period. Similarly, a negative correlation between self-reported GPA and playing video games of Social media and Shooter genres was found in the study of 252 undergraduate students (Ventura et al., 2012). In 2006, Sharif and Sargent also found that gaming during the weekdays for more than one-hour had a negative effect on the GPA of 4 508 students from Grades 5-8. Thus, studies have shown this negative effect across all grade levels and that excessive play can possibly have a greater negative effect on students with higher GPA.

Since numerous studies have identified a clear negative association between the amount of time spent by students on electronic gaming and their academic performance, an increasing number of scientists have come to the conclusion that obsession with video gaming promotes addictive behavior among video gamers of all ages (Anand, 2007; Islam et al., 2020; Lin et al., 2013; Rehbein et al., 2010; Sharif & Sargent, 2006; Skoric et al., 2009). Lin et al. (2013) claimed that “the higher the frequency and the longer the time spent in video gaming each week, the higher the tendency for game addiction” (p. 64). In their study of 1 704 children between 11 and 17 years of age, Islam et al. (2020) reported that children addicted to digital gaming, (i.e., spending more than the recommended maximum two hours per day), had fewer chances of receiving higher scores on the standardised test of academic performance called The National Assessment Program - Literacy and Numeracy (NAPLAN) in comparison to students without video game addiction.

Researchers also provided other reasons for an academic performance decline caused by the excessive video gaming, suggesting that excessive gaming was connected to demotivation to learn, increased truancy, devoting less time to homework, falling asleep in

class, attention deficits, misbehavior, aggression, and depression (Anand, 2007; Ferguson, 2015; Granic et al., 2014; Gentile, 2009; Islam et al., 2020; Rehbein et al., 2010).

Another possible reason for diminished scholastic performance is students' increased aggression due to playing violent video games. Lynch et al. (2001) conducted a study involving 607 students in Grades eight and nine from four schools and found a negative correlation between violent video games and school academic achievements. Abnormal gaming of middle and high school students in violent digital contexts was determined to be connected to fighting with classmates and quarreling with teachers, increased irritability, and lack of control (Anderson et al., 2007; Bowers & Berland, 2013; Lynch et al., 2001).

Overall, the existing body of literature suggests that excessive video gaming, addiction to play, and engagement with violent games can negatively affect the academic performance of students in both school assessment and standardised examinations, where studies focused on students' school grades prevail.

Positive Effect of Playing Games on Children's Academic Achievements

Much work on the benefits of playing ordinary games on children's healthy growth has been conducted by a number of scholars in the field of developmental psychology (e.g., Erik Erikson, 1977; Jean Piaget, 1999; Lev Vygotsky, 1978). Presently, a growing number of scientists have reported a positive influence of playing digital games on students' academic achievements based on their empirical studies. The emerging body of literature has indicated that recreational video gaming can develop an ability to apply knowledge in solving real-life problems, as players gain "multiple deep understandings in a motivating way" which "is often much easier for students than learning disconnected simple facts or surface-level understandings" (Harel & Papert, 1980, as cited in Bowers & Berland, 2013, p. 53).

Considering these video gaming benefits to children's cognitive development, an increasing number of researchers started to investigate the potential impact of video gaming on students' scholastic performance (Bowers & Berland, 2013; Ferguson & Olson, 2013; Granic et al., 2014; Islam et al., 2020). Willoughby (2008) found a positive correlation between playing video games and academic progress based on a survey conducted with 1 591 Grade 9-12 students in Canada, which contained questions about school grades, educational career plans, and academic progress. In the same year, Wittwer and Senkbeil (2008) also found a positive association between non-pathological video gaming and mathematical scores on the 2003 PISA in the study of 4 660 15-year-olds in Germany. Similar results were found with English test scores, obtained directly from schoolteachers, in a study conducted with 333 children aged eight to 12 in Singapore, and "a significant positive association between the amount of time spent playing video games on weekdays and English test scores" was found (Skoric et al., 2009, p. 570). They concluded that English language proficiency had been enhanced due to the devotion of more time to video gaming to understand the game instructions properly and win in the game. Similarly, Islam et al. (2020) found that moderate video gaming during weekdays and weekends had a positive impact on reading scores as measured by NAPLAN, where 1 704 Australian students aged 11-17 participated. Thus, the researchers suggested that it may be the consequence of reading difficult texts and comprehending challenging game logic in order to succeed in the game. Similarly, positive correlations have been established between moderate daily recreational video gaming (one-two hour) and mathematics and reading skills tested by the National Center for Education Statistics among a sample of 13 960 high school students in the United States (Bowers & Berland, 2013). They claimed that video gaming has the same positive influence on students' academic conduct as "homework outside of school, extracurricular activities, and reading outside of school"

(Bowers & Berland, 2013, p. 64). A positive association between video gaming frequency and mathematics, reading, and science scores of PISA 2012 was also established in a study conducted with 12 018 15-year-old Australian children (Posso, 2016).

Researchers have also considered other aspects of video game playing, which had a positive relationship with the academic progress of young players. In their study with five and six-year-old children, Cortex and Bugental (1995) found that after engaging with violent content, children's stress levels were reduced and they became more perceptive to absorb new information (cited in Olson, 2010). This can be useful for the interested parties in understanding the ways of knowledge acquisition by students in a classroom.

Collectively, the reviewed literature suggests that video gaming can positively affect the academic performance of students both in schools and standardised assessments, where the majority of studies identified the positive effect on the academic outcomes of standardised tests.

Zero Effect of Playing Games on Children's Academic Achievements

Previous studies had also identified zero or null relationships between video game playing and academic progress. In 2006, Sharif and Sargent found that gaming during the weekends had no effect on the GPA of 4 508 students in Grades five-eight. In their study with 333 primary school students aged 8-12 in Singapore, Skoric et al. (2009) found a significant positive correlation between the video gaming on weekdays and English test scores but insignificant relationships with Mathematics and Science test scores. In addition, they discovered insignificant relationships between playing digital games on weekends and English, Mathematics, and Science test scores. The authors suggested that such outcomes could be explained by the fact that gamers' high engagement in video gaming due to positive experiences did not hamper students' ability to manage their time properly to accomplish their school assignments in a timely manner.

In addition, Ferguson (2011) reported no association between video gaming and students' GPA, as reported by parents, based on his study of 603 Hispanic children of 10-14 years old. In the same year, Jackson et al. (2011) conducted a study with 482 students from 20 Michigan secondary schools and found no influence of video gaming on students' school performance with below or above average GPA. Similarly, no effect between self-reported GPA and playing video games of the Fighting, Role-playing, Action-Adventure, Puzzle, Platformer, Strategy, and Simulation genres was found in the study on 252 undergraduate students (Ventura et al., 2012). No relationship was identified between playing video games of Combat and Violence, Puzzles and Strategy, Sports and Racing, and teachers' evaluation of Grade seven 217 students' academic engagement, reported by teachers (Przybylski & Mishkin, 2016). Later, Terry and Malik (2018) also found no predictive correlation between 82 Grade nine Canadian students' final marks in English language arts, obtained in the form of overall final percentages, and the amount of time spent playing video games. The same year Dindar (2018) published his study on 479 high school Turkish students, which did not determine any significant effect of playing video games during weekdays and weekends as well as played video game genres on players' self-reported GPA for the last school term. More recently, Islam et al. (2020) found no effect of video gaming during weekends on NAPLAN numeracy scores of 1 704 Australian students aged 11-17. These findings contradicted the results of research about the negative and positive effects of video gaming; however, researchers suggested that this could be due to gamers' effective time-management skills, which allowed them to allocate enough time for both studying and gaming (Skoric et al., 2009) or due to the objectivity of students' self-reports of their own grades and self-perceptions of academic performance, employed in the studies (Drummond & Sauer, 2014).

An extensive study of the impact of digital gaming on students' academic performance was implemented by Drummond and Sauer (2014). The authors conducted an analysis of 192 000 students from 22 countries, which participated in the 2009 PISA and found an insignificant association between the frequency of video gaming and students' academic performance. Unlike previous research, the authors of this study emphasised that they employed results from PISA, which is considered to be a psychometrically reliable and valid standardised test and respectively diminishes teachers' possible bias in their assessment grades (Drummond & Sauer, 2014). More recently, Gnambs et al. (2020) in their longitudinal study established no effect of video gaming frequency on 3 554 students' mathematical and reading competencies measured by achievement tests designed for the administration of the German National Educational Panel Study (NEPS) during Grades nine and 12.

The studies presented thus far provide evidence about zero effect of playing digital games on students' school and standardised assessment results, where much literature utilised unstandardised academic outcomes of students. Thus, they refute the findings of other studies, considered in this paper, which reported negative and positive associations between students' video gaming and their academic achievements in both school and self-reported grades (Anderson & Dill, 2000; Anderson et al., 2007; Lynch et al., 2001; Rehbein et al., 2010; Sharif & Sargent, 2006; Skoric et al., 2009; Terry & Malik, 2018; Ventura et al., 2012; Willoughby, 2008) and standardised test performance (Bowers & Berland, 2013; Drummond & Sauer, 2014; Ferguson, 2011; Islam et al., 2020; Jackson et al., 2011; Jaruratanasirikul et al., 2009; Lin et al., 2013; Posso, 2016; Wittwer & Senkbeil, 2008).

The extensive range of sources provided controversial findings, which indicates the absence of general agreement about the effects of video gaming on students' academic

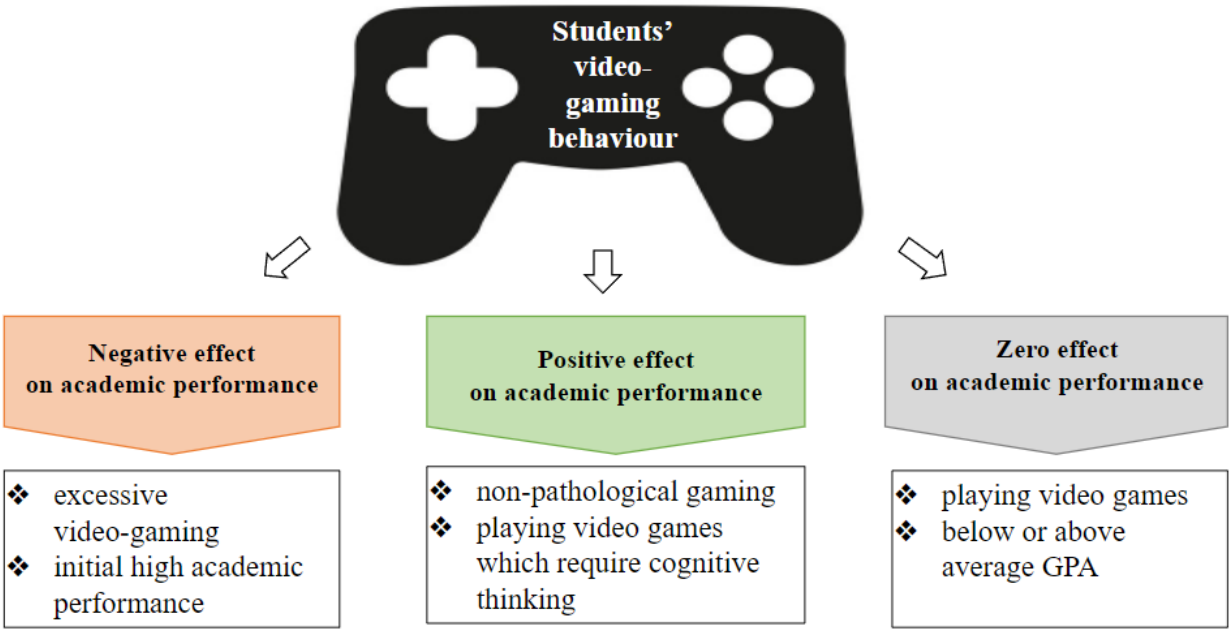
performance, presented in the form of school grades and standardised test scores. Students' results on standardised assessments, employed for analysis in the reviewed literature, represent achievement test results, which monitor students' scholastic performance within subjects on national (NAPLAN, Australia) and international levels (PISA) periodically. However, so far no attention has been paid to the examination of the impact of playing video-games on students' results in standardised school admission tests. This type of tests usually has high stakes, as students' test performance has a direct effect on their future academic journey and therefore demand a great amount of time and effort with additional preparations as well as maintaining an appropriate study-life balance. Considering the high-stakes nature of entrance examinations to specialised, private, or gifted schools, the results of the associated study are valuable for the interested stakeholders and relevant fields of theoretical knowledge.

Conceptual Framework

Considering the existing research on video games' effects on students' academic achievements, it might be concluded that the time spent playing video games, their genre, and students' initial academic performance have negative, positive, or zero influence on students' academic achievements in both subjective (school grades or self-reports) and objective (standardised) assessments. Therefore, based on this empirical evidence, the following conceptual framework is proposed in Figure 2.

Figure 2

Conceptual Framework



As seen in Figure 1, the present study conceptualises that playing video games can have positive, negative, and zero effects on students' academic performance according to the reviewed literature. The negative impact on students' academic achievements can occur due to excessive playing of video games which reduces the players' time for studying and homework as well as for students with an initial high level of academic performance (Anderson et al., 2007; Cummings & Vanderwater, 2009; Islam et al., 2020; Jackson et al., 2011). The positive effect on students' scholastic performance was determined by non-pathological gaming as well as playing video games, which have a positive effect on players' cognitive development by improving their spatial reasoning, problem-solving and strategic thinking skills (Adachi & Willoughby, 2013; Bowers & Berland, 2013; Cherney, 2008; Gee, 2005; Granic et al., 2014; Green & Bavelier, 2012; Islam et al., 2020; Skoric et al., 2009; Wai et al., 2009; Willoughby, 2008; Wittwer & Senkbeil, 2008). Zero effect of playing video games on students' academic performance was also established and specifically for those students who had below or above average GPA, which was explained

by possible good time-management skills of students engaged in video gaming (Drummond & Sauer, 2014; Ferguson, 2011; Jackson et al., 2011; Skoric et al., 2009; Terry & Malik, 2018).

Based upon the findings of the above research, it was hypothesised that students who spent much time playing video games and who had an initial high level of academic performance at school would experience negative effects on their selection test results. At the same time, students who played video games moderately and/or played video games that enhance their cognitive thinking would demonstrate higher results on the NIS selection test than the first group of students. Finally, zero effect on students' selection test results may be determined as well, especially for those students who had below or above average scholastic performance in Grade six.

The supposed effects were examined by the quantitative analysis of independent variables, which are students' responses to a video gaming questionnaire, and dependent variables, which are their results on five selection test domains: Mathematics, Quantitative reasoning, Kazakh language (as first or second), Russian language (as first or second), and English. The extraneous variables - students' gender, age, first language, and region of residence (urban/rural) were controlled in the study. Thus, the research design, questions, hypotheses, and analysis methodology of the present study were determined to examine the significance level of indicated conceptual relationships between measured variables and draw meaningful conclusions from the research-based evidence (Hughes et al., 2019).

The outcomes of this research contribute to a better understanding of the implications of the video gaming behaviour of Kazakhstani 12-14-years old students on their NIS standardised selection test results. These findings are valuable for the interested stakeholders, (i.e., parents and teachers, who play an important role in monitoring and adjusting students' recreational activities, as well as policymakers, who are responsible for

the development of legislation for video gaming practices regulation among adolescents). Moreover, taking into account a paucity of research on the impact of students' video gaming on the results of high-stake entrance examinations to selective secondary schools, specifically, NISs, the results of this research helps to address this research gap.

Conclusion

Overall, this chapter analysed and synthesised the available literature and results of in vitro studies about students' video gaming and its effect on their cognitive development as well as academic achievements. The experimental data are rather controversial, and there was no general agreement about the factors which have been shown to have positive, negative, or zero effects of video gaming on students' scholastic performance.

Although extensive research has been carried out on the topic, much uncertainty still exists about the relationship between students' video gaming and high-stakes standardised entrance examination results to selective schools like NISs. This indicates a need to examine the possible influences of NISs applicants' video gaming experiences on their academic performance in seven NIS selection subtests.

The third chapter is concerned with the methodological approach taken in this study to answer the research questions and test hypotheses, designed to examine the effect of students' video gaming on their NIS selection test results.

Methodology

Introduction

This chapter presents and justifies the methodology employed to examine the effect of students' self-reported video gaming experiences on their results on seven NIS selection test subtests to enter Grade seven for the 2021-2022 academic year. The study examined the following research questions and tested the following null hypotheses:

RQ1: What video games and video game genres were the most popular for the sample of students during the months leading up to the NIS selection test?

Hypothesis 1: There were no popular video games and video game genres for the sample of students during the months leading up to the NIS selection test.

RQ2: How does the performance for each subject of the NIS selection test compare between the sample and the population of students?

Hypothesis 2: There is no difference between the performance of the sample and the population of students for each subject of the NIS selection test.

RQ3: What effect does the students' video gaming behaviour have on their NIS selection test results for the sample?

Hypothesis 3: Students' video gaming behaviour does not affect their performance on the NIS selection test.

The chapter contains several sections, which provide information about the research design and the rationale for its selection, the research site, sample and sampling procedures, data collection instruments and procedures, data analysis methods, ethical concerns, and possible research risks.

Research Design and Rationale

To date, various methods have been developed and introduced to measure the effect of playing video games on students' academic achievements. However, quantitative design

became the predominant approach in this field of research, since it allows the researcher to measure and evaluate the causal relationship between the large sets of numerical data as well as make deductive predictions through analysing a group of individuals and generalising the results to a larger population (Creswell, 2012; O'Dwyer & Bernauer, 2013).

A qualitative research design is unable to establish any associations between different concepts using large amounts of data, as it is usually employed for the exploration of the central phenomenon and development of an in-depth understanding of the problem within its context (Cohen et al., 2007; Creswell, 2014). Therefore, a qualitative approach is incapable of answering the research questions of the present study, thus it was not utilised in this research.

The present research applied a non-experimental or non-intervention correlational research approach since it examined naturally occurring relationships between variables of the sample of the population (Creswell, 2012; O'Dwyer & Bernauer, 2013). Furthermore, grounded assumptions were made on whether the variables could predict each other on the basis of an established degree of correlations (O'Dwyer & Bernauer, 2013). In the current research, there were four categorical and continuous independent variables (students' responses to video gaming questions) and seven continuous dependent variables, (students' scores on Mathematics, Quantitative Reasoning, Kazakh language as the first language, Russian language as the first language, Kazakh language as the second language, Russian language as the second language, and English language) (O'Dwyer & Bernauer, 2013). There were also some categorical extraneous variables - students' gender, and area of residence (rural/urban) which were controlled in the study.

Research Site

There was no specific research site where the study was conducted. The study analysed secondary data, specifically, NIS selection test results on seven subtests, and self-reported video gaming experiences of students. The author obtained all secondary data from the NIS selection test centre, Center for Pedagogical Measurements (henceforth, CPM) which is a branch of the autonomous educational organisation "Nazarbayev Intellectual schools", via an official letter containing the necessary explanation about the research purpose and methodology.

Sample and Sampling Procedures

The present study employed secondary data, therefore there was no need to follow any sampling strategies for data collection. The secondary data included the NIS selection test results on seven subtests of 17 664 students, who took the selection test in May 2021, representing the population of the study, and self-reported video gaming habits of 335 applicants out of 17 664 students, who filled in the video gaming questionnaire.

Data Collection Instruments and Procedures

Secondary data mentioned in the previous section were provided to the author by CPM in an anonymised form in reply to the author's official request. The data were in two Microsoft Excel files: the first file contained ID, demographic data, and selection test results of 17 664 students, and the second file contained ID and responses to the video game playing questionnaire of 335 students (i.e., the initial study sample).

The students' results on seven selection test domains were represented by psychometrically calculated scores for each subtest. Mathematics and Quantitative Reasoning additionally contained a percentage expression of students' performance, because these subtests have threshold scores: 35% and 40% respectively. Total scores for Day 1 (Maths and QR) and Day 2 (Language) tests as well as total score on both test days

were indicated for each candidate. Detailed information about the 2021 NIS selection test is presented in Table 1. Examples of selection test questions within the subtests are provided in Appendix A.

Table 1

NIS Student Selection Test Structure

#	Subtests	Number of test items	Duration in minutes	Maximum score	Threshold score	Grant allocation scheme
1	Mathematics	40	60	400	140 (35%)	Educational grants are awarded to applicants, who received a higher overall score on tests (max. - 1300), within the allotted grants for specific schools
2	Quantitative Reasoning	60	30	300	120 (40%)	
3	Kazakh language (first/second)	20	40	200	-	
4	Russian language (first/second)	20	40	200	-	
5	English language	20	40	200	-	
	Total	160	210	1300		

Note. Students who have achieved the threshold scores both in Mathematics and Quantitative Reasoning can be considered for a review by the Republican Committee, which awards the educational grant for NIS attendance.

The video game questionnaire data included students' IDs, demographic data, and self-reported information about students' habits, attitudes, and preferences of video games played at the time of preparation for the NIS selection test. It asked about what genres of games they liked to play, what were their favourite video games, and how much they played on weekdays and weekends. The full set of questions in original languages (Kazakh and Russian) with their translation into the English language can be found in Appendix B.

The questionnaire data clean-up determined that there were students who took the questionnaire twice due to identical IDs. Therefore, one of the duplicates, which provided less information for analysis in comparison with the student's other reply, was removed reducing the sample size from 355 to 309 students. There was only one open-ended question, which asked students to write one or two of their favourite video games. As a result, students indicated from one to four favourite video games in this section. They wrote the video game titles in English and/or Russian languages in full or shortened forms, and most of them were written incorrectly, for example, *"warthunder", "мортал комбат", "csgo", "Варфейс", "Sonic the hadghog"*, etc. Therefore, the self-reported favourite games needed some corrections, since it was impossible to conduct any statistical analysis in its original form. In the data spreadsheet, additional four columns were created for indication of the proper video game title from the Internet separately in each column. Then a check for the existence of overlapping video game titles was done to detect and correct any mistakes, which occurred during writing the correct video game titles in the new columns, for example, *"Genshin impact" and "Genshin Impact", "The Sims IV" and "The Sims 4", etc*. There were also students, who did not indicate any favourite video game. These students were removed from the dataset because the name of the video game was one of the most important variables to analyse and answer RQ3. Thus, the sample size was reduced again from 309 to 255 students.

After finalising the columns with favourite videogames, an additional four columns were created to indicate the genre of students' favourite games, which was required to answer RQ3. Therefore, the author referred to Wikipedia's list of video game genres (see Figure 1) and wrote the genre of the favourite video game columns in the next column (List of video game genres, 2022). Considering the broad variety of video game genres, the main 16 video game genres were taken into account in this study, because assigning the

particular genre to every video game would result in a long list of genres, which would cause certain difficulties during the analysis. Additionally, video game genres were assigned a code in a separate column for further statistical analysis.

After cleaning and expanding of students' video gaming experiences data, it was merged with the students' selection test results and demographic data via students' ID into one Microsoft Excel file to prepare a full dataset. Then this dataset was assessed for completeness and skewness of every variable (i.e. for the presence of selection test results, and full appropriate answers to the questionnaire questions). This data assessment revealed no mismatch, therefore, the sample size remained at the same number of students, 255, comprising the sample of this study. The final cleaned data was translated into English for analysis convenience. The demographic information of the sample as well as the number of students who achieved the threshold scores in Mathematics and Quantitative Reasoning within the language of instruction is presented in Table 2.

Table 2

Demographic Data on the Sample of NIS Selection Test Takers

	Kazakh mode of instruction	Russian mode of instruction	Total
Gender			
Male	85	78	163
Female	56	36	92
Age			
12 years old	58	35	93
13 years old	83	78	161
14 years old	0	1	1
Region			
urban	125	111	236
rural	16	3	19

Thresholds in Mathematics and Quantitative Reasoning			
students, who passed the thresholds	120	103	223
students, who did not pass the thresholds	21	11	32
Total	**141**	**114**	**255**

Data Analysis Methods

The analysis of data was implemented with the help of an open-source R statistical software (R Core Team, 2019). Specifically, to answer RQ1, (i.e., What video games and video game genres were the most popular for the sample of students during the months leading up to the NIS selection test?), descriptive analysis was implemented using basic R functions, reporting the frequencies and percentages for each video game and genre, which were represented as nominal data (Cohen et al., 2002). The results of this exploratory analysis were shown in the form of a frequency table and a pie-chart for each video game and genre (Cohen et al., 2002).

To answer RQ2 (i.e., How does the performance for each subject of the NIS selection test compare between the sample and the population of students?) inferential statistics were employed using the Levene's test for equality of variances and common independent sample *t*-test to examine the differences in the scores of seven subtests of the NIS selection test of the students in the sample and population respectively for statistical significance (Bates et al., 2014; Cohen et. al, 2002). For practical significance Cohen's *d* was employed to calculate the effect size of the difference in test performance of the sample and the population with the following references - 0.2, 0.4, and 0.6 for small, medium, and large effects respectively (Cohen, 1992; Hattie, 2008).

To answer RQ3 (i.e., What effect does the students' video gaming behaviour have on their NIS selection test results for the sample?) multiple regression was employed as a primary method of analysis to examine the effect of students' video gaming habits on their NIS selection test results while controlling for the effect of their age, gender, first language, locality of residence (i.e., extraneous variables) (Cohen et. al, 2002). For these purposes the extraneous variables were coded in the following way - gender as 1 (female) and 2 (male), the language of instruction as 1 (Kazakh) and 2 (Russian), region of residence as 1 (rural), 2 (urban), and age as 9 (12 years old), 8 (13 years old), 7 (14 years old). At this stage, the results of the seven subtests of the NIS student selection test were modelled as dependent variables while students' responses on their favourite video game, determined video game genres, and self-reported amount of hours spent playing video games on weekdays and weekends were modelled as predictor (i.e., independent) variables. Considering the different language tests for students with Kazakh and Russian languages of instruction, it was decided to conduct the multiple regression analysis in three models. Model 1 calculated the effect of playing video games on Mathematics and Quantitative Reasoning scores of students with Kazakh and Russian modes of instruction. Model 2 examined the effect of playing video games on Language test scores designed for Kazakh speaking students. Model 3 determined the effect of playing video games on Language test scores designed for Russian speaking students. The analysis of models 2 and 3 was conducted with the exclusion of the language variable because the language was already assumed in these Language test models. The implementation of multiple regression analysis was done using the lavaan package of R Studio (Rosseel, 2012).

Ethical Concerns and Risks of Research

All research procedures were conducted in accordance with all ethical standards, although the study used secondary data, which means very low risk to its participants as no

identifying data was provided. Moreover, the results of this study determined general patterns without having the ability to specify any particular students as no identifying data was provided to the researcher. Thus, anonymity and confidentiality were provided.

Conclusion

Overall, this chapter reviewed the methodology used for this study, indicating the research design with the rationale, data collection instruments, and procedures, as well as the analysis techniques. The fourth chapter presents the findings of the research, focusing on three research questions.

Findings

Introduction

The chapter presents the findings of the quantitative analysis performed to examine the effect of students' video game playing on their NIS selection test results, consisting of seven academic domains. The main research questions asked how students' video game experiences affected their selection test results. To answer these questions multiple regression analysis was used to identify the association between video game genres, amount of hours spent playing video games on weekdays and weekends, and selection test results on Mathematics, Quantitative Reasoning, Kazakh as the first and second languages, Russian as the first and second languages, and English language. The present chapter consists of four sections. The first three sections present the results of statistical analysis conducted to answer the three research questions and test the null hypotheses. The last section concludes the chapter, summarising the analysis results.

The Most Popular Video Games and Video Game Genres for the Sample of Students during the Months Leading up to the NIS Selection Test

RQ1: What video games and video game genres were the most popular for the sample of students during the months leading up to the NIS selection test?

Hypothesis 1: There were no popular video games and video game genres for the sample of students during the months leading up to the NIS selection test.

In total 83 unique video games were played by the sample of students (n=255) before the NIS selection test. Frequency analysis (as seen in Appendix 3) found that the most popular video games were *Minecraft* (n=42, 16.5%), *Brawl Stars* (n=26, 10.2%), *Counter-Strike: Global Offensive* (n=17, 6.7%), *Roblox* (n=14, 5.5%), and *FIFA* (n=11, 4.3%). Another 27 video games were played by only 2-9 students according to the questionnaire. Another 56 video games were listed by only a single student in the sample.

In total 16 video game genres related to the 83 video games played by students in the sample were identified by the author (as seen in Appendix C). The frequency analysis in Table 3 and Figure 3 shows that *Action* video games were the most favourite among the students accounting for 51 (20%) of the most selected game classifications by the students followed by *Sandbox*, *Strategy*, *Role-playing*, *Puzzle,* and *Sports* video games. Whereas the least favourite video game genres among students who responded to the survey were *Art*, *Party,* and *Social deduction games* (in the latter game players attempt to deduce one another's roles, for example, *Among Us*). Thus, the results of the analysis do not support the null hypothesis stated in the first research question of this study as there were common popular games within the study sample.

Table 3

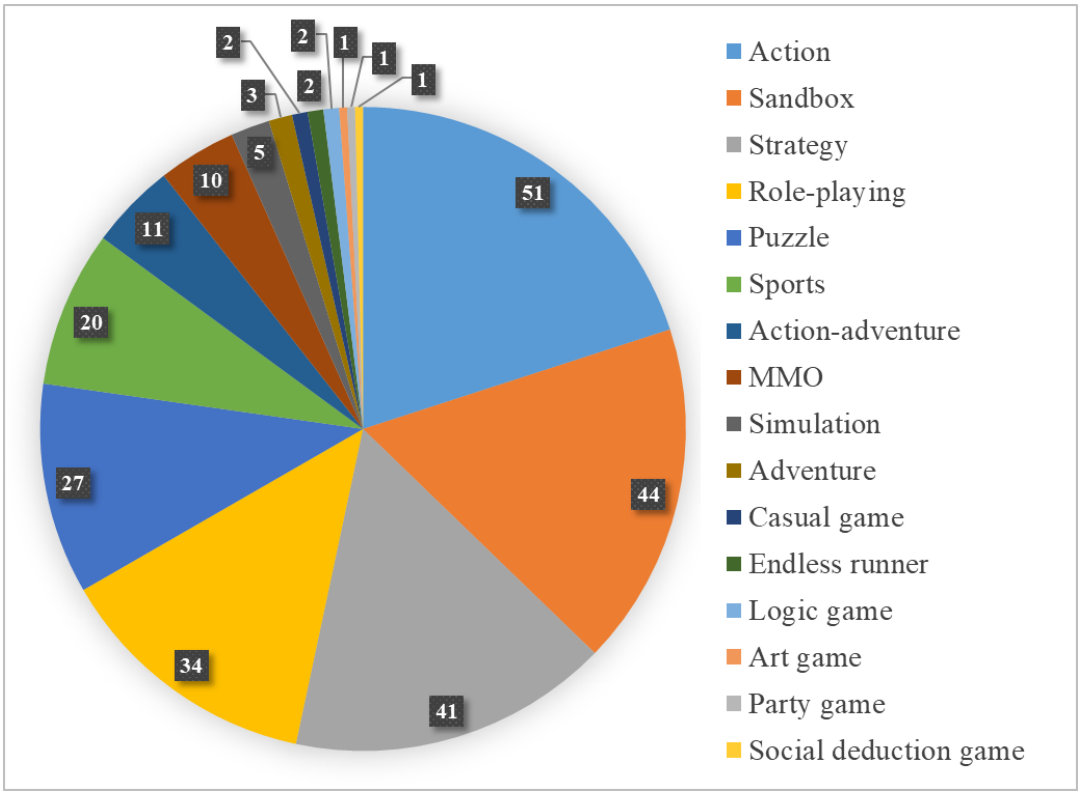
Frequency Table of Video Game Genres Played by 255 NIS Candidates

Video game genre	Frequency	Percentage
Action	51	20.0%
Sandbox	44	17.3%
Strategy	41	16.1%
Role-playing	34	13.3%
Puzzle	27	10.6%
Sports	20	7.8%
Action-adventure	11	4.3%
MMO	10	3.9%
Simulation	5	2.0%
Adventure	3	1.2%
Casual game	2	0.8%
Endless runner	2	0.8%
Logic game	2	0.8%
Art game	1	0.4%

Party game	1	0.4%
Social deduction game	1	0.4%
Total	255	100%

Figure 3

Pie-chart of Video Game Genres Played by 255 NIS Candidates



Note. The numbers represent the quantity of students who played the indicated video game genre.

The Comparison of Performance for Each Subject on the NIS Selection Test of the Sample and the Population

RQ2: How does the performance for each subject of the NIS selection test compare between the sample and the population of students?

Hypothesis 2: There is no difference between the performance of the sample and the population of students for each subject of the NIS selection test.

In this part, we aimed to compare the performance of the whole population of students (N=17,664) with the survey sample (n=255). The comparison was made using the common independent sample t-test with prior checking for homogeneity of variances by way of the Levene's test. An alpha level of 0.05 was employed for that test. The Levene's test suggested that the homogeneity of variances was met. Descriptive statistics, post-hoc independent t-test results, and the effect sizes are shown in Table 4.

Table 4

Independent Sample T-test for the Difference in Means between the Students in the Sample and Population

Subject	N (pop.)	N (sample)	Mean (pop.)	SD (pop.)	Mean (sample)	SD (sample)	Mean Diff	*t*	*df*	p value	Effect Size *(d)*
Mathematics	17,664	255	168.9	97.39	273.9	97.19	105.0	-17.105	17,917	<.001***	1.078
Quantitative Reasoning	17,664	255	155.1	55.08	212.5	53.07	57.3	-16.524	17,917	<.001***	1.042
Kazakh as the first language	11,970	141	129.4	30.59	142.7	26.52	13.3	-5.9198	12,109	<.001***	0.436
Kazakh as the second language	5,694	114	93.2	46.33	99.9	47.82	6.6	-1.5134	5,806	.1302	0.143
Russian as the first language	5,694	114	137.7	34.65	158.6	27.26	20.9	-8.0541	5,806	<.001***	0.605
Russian as the second language	11,970	141	133.1	40.75	163.9	28.76	30.8	-12.578	12,109	<.001***	0.758
English for Kazakh students	11,970	141	98.3	46.22	142.2	45.17	43.8	-11.212	12,109	<.001***	0.949
English for Russian students	5,694	114	116.8	45.84	147.4	36.66	30.6	-8.7753	5,806	<.001***	0.669

Note. *p<.05, **p<.01, ***p<.001, ****p<.0001

The results of the *t*-test showed that the average performance of the students in the sample in all subtests except *Kazakh as the second language* ($t(5,806)=-1.5134$, $p=.1302$, $d=0.143$) significantly differed from the population's test results. Large effect size was noted across *Mathematics* ($d=1.078$), *Quantitative Reasoning* ($d=1.042$), and *English language* for students with the Kazakh language of instruction ($d=0.949$) subtests, which indicates a strong degree of practical significance. The effect size of the mean results difference is medium in *Russian language as the first* ($d=0.605$) and *second languages* ($d=0.758$), and *English language* for the students with the Russian language of instruction ($d=0.669$) subtests. Overall, the results of the independent *t*-test revealed that the performance of the students of the sample was significantly higher than that of the population, which rejects the null hypothesis.

The Effects of the Students' Video gaming Behaviour on their NIS Selection Test Results

RQ3: What effect does the students' video gaming behaviour have on their NIS selection test results for the sample?

Hypothesis 3: Students' video gaming behaviour does not affect their performance on the NIS selection test.

Multiple regression analysis was performed to identify and determine the impact of students' video game habits before the NIS selection test on their test performance. The analysis was conducted to determine how the video game genre (n=16) and the number of hours spent playing video games (from zero to 10 hours a day) during weekdays ($M=1.73$, $SD=1.39$) and weekends ($M=2.72$, $SD=1.88$) predicted the students' scores on the selection test's academic domains (n=7), controlling for some demographic variables (n=4). The results of multiple regression analysis are presented in Table 5.

Table 5

Multiple Regression Analysis of Video Game Experience on Subject Performance

Variables	Mathematics		Quantitative Reasoning		Kazakh as the first language		Kazakh as the second language		Russian as the first language		Russian as the second language		English for Kazakh students		English for Russian students	
	Est.	P value	Est.	P value	Est.	P value	Est.	P value	Est.	P value	Est.	P value	Est.	P value	Est.	P value
Video game genres																
Action	0.10	.221	0.15	.068	0.12	.246	-0.13	.351	0.28	<.05*	0.09	.415	0.13	.223	0.12	.418
Sandbox	0.17	<.05*	0.17	<.05*	0.11	.257	-0.25	.067	0.19	.146	-0.02	.827	0.19	.056	0.01	.929
Strategy	0.20	<.05*	0.29	<.05*	0.24	<.05*	-0.08	.546	0.23	.085	0.07	.466	0.07	.498	0.07	.632
Role-playing	-0.02	.731	-0.07	.914	0.12	.132	0.12	.164	-0.15	.086	0.12	.139	0.04	.665	-0.01	.936
Puzzle	0.11	.154	0.08	.284	0.07	.500	0.11	.324	0.04	.676	-0.06	.561	-0.06	.551	-0.01	.894
Sports	0.07	.363	0.05	.443	-0.04	.972	0.15	.149	0.24	<.05*	-0.13	.175	-0.06	.566	0.14	.213
Action-adventure	0.08	.200	0.10	.102	0.02	.777	0.05	.620	0.11	.252	-0.09	.311	-0.01	.900	0.07	.494
MMO	0.07	.289	0.10	.118	0.12	.146	0.04	.973	0.14	.192	0.01	.910	0.08	.347	0.01	.905
Simulation	0.08	.175	0.12	<.05*	0.03	.972	0.05	.959	0.16	.082	0.07	.418	0.13	.121	-0.03	.779
Adventure	-0.05	.383	-0.04	.499	-0.14	.081	-0.07	.935	0.08	.366	-0.01	.881	-0.02	.770	0.01	.893
Casual game	0.09	.126	0.09	.113	0.05	.540	-0.06	.497	0.16	.066	0.06	.439	0.01	.977	0.11	.214
Endless runner	0.03	.555	0.06	.306			0.17	.059	-0.03	.764					0.15	.106

Logic game	-0.05	.354	-0.03	.650	-0.07	.409	-0.05	.527	0.07	.434	-0.13	.110	0.01	.849	-0.07	.415
Art game	0.06	.279	0.10	.068			0.06	.509	0.09	.239					0.09	.296
Party game	0.03	.639	0.04	.505	0.13	.098					0.04	.608	0.10	.182		
Social deduction game	-0.12	<.05*	-0.13	<.05*	-0.07	.371					-0.01	.867	-0.09	.232		
Amount of hours spent playing video games on:																
Weekdays	-0.33	*<.001***	-0.22	<.05*	-0.13	.305	-0.49	*<.001***	-0.45	*<.001***	-0.02	.898	-0.09	.466	-0.31	<.05*
Weekends	0.27	*<.01***	0.21	<.05*	-0.04	.736	0.43	*<.01***	0.39	*<.01***	-0.02	.849	0.13	.306	0.29	<.05*
Demographic data																
Age	0.05	.413	0.04	.534	0.04	.602	-0.05	.542	0.25	*<.01***	0.05	.555	-0.11	.197	0.15	.100
Region of residence	0.13	<.05*	0.15	*<.01***	-0.05	.588	0.04	.604	0.19	<.05*	0.26	*<.01***	0.25	*<.01***	0.18	<.05*
Gender	0.14	<.05*	0.21	*<.001****	-0.21	<.05*	-0.06	.522	-0.08	.408	-0.13	.147	-0.22	<.05*	-0.14	.154
Language of instruction	0.07	.232	0.05	.379												

Note. *p<.05, **p<.01, ***p<.001, ****p<.0001

The multiple regression analysis of the effect of video gaming behaviour on *Mathematics* scores of students with Kazakh and Russian languages revealed a statistically significant positive correlation between the following independent variables: playing time during weekends (p=.006), playing *Sandbox* (p=.037), and *Strategy* games genres (p=.011) as well as being *urban* (p=.041), and *male* (p=.028). *Sandbox* video game genre included two games - *Minecraft* with 42 students and *Terraria* with two students. *Strategy* game genre included *Brawl Stars* with 26 students, *Clash Royale*, *Dota*, *League of Legends*, some strategic games with two students playing each game, and *Checkers*, *Civilization*, *Clash of Clans*, *Hearts of Iron IV*, *Plants vs Zombies*, *StarCraft*, *Suspects* with one student playing each game. Whereas statistically significant negative correlations were found between the following independent variables: playing time during weekdays (p=.001) and playing *Social deduction* games genre (p=.034), which was represented by only one student playing *Among Us*. The analysis did not show any statistically significant effect of playing all other video game genres as well as students' age and first language on *Mathematics* test scores, which supported the null hypothesis.

The analysis results of *Quantitative Reasoning* scores of students with Kazakh and Russian languages revealed similar results. Statistically significant positive relationships were found between the following independent variables: being *male* (p=.001), and an *urban* student (p=.010), playing video games during weekends (p=.027), playing *Sandbox* (p=.028), *Strategy* (p=.011), and *Simulation* games genres (p=.038). *Simulation* video games genre included *The Sims 4*, played by two students, and *Barvicha*, *Jurassic World Evolution*, *Legend of the Phoenix*, each played by one student. Statistically significant negative relationships were found between the following independent variables: playing time during weekdays (p=.015), and playing *Social deduction* games genre (p=.028), which was represented by only one student playing *Among Us*. The analysis did not show any statistically significant effect of playing all other video game genres as well as students' age and first language on *Quantitative Reasoning* test performance, which supported the null hypothesis.

The initial multiple regression modelling of the impact of video gaming experiences on the *Language test* results of students with the Kazakh language of instruction identified no variance for two independent variables *Endless runner* and *Art game*, therefore these variables were excluded from the model. The results of the adjusted regression modelling showed statistically significant positive effects of playing the *Strategy* games genre (p=.015) on *Kazakh as the first language* test scores, being *urban* on *Russian as the second language* (p=.004) and *English language* (p=.005). While statistically significant negative effects were established between being *male* and *Kazakh as the first language* (p=.013) and *English language* (p=.011). The analysis did not show any statistically significant effect of playing during weekdays and weekends, other video game genres, and students' age on the *Language test* performance of Kazakh speaking students, which supported the null hypothesis.

The initial multiple regression modelling of the impact of video gaming experiences on the *Language test* results of students with the Russian language of instruction identified no variance for two independent variables *Party game* and *Social deduction game*, therefore these variables were excluded from the model. The results of the adjusted regression modelling revealed a statistically significant positive correlation between playing time during weekends and all three languages - *Russian as the first language* (p=.005), *Kazakh as the second language* (p=.003), and *English language* (p=.049). Students' test results of *Russian as the first language* subtest had a statistically significant positive correlation with playing *Action* (p=.035), and *Sports* (p=.022) games genres, being older (p=.003), and *urban* student (p=.018). *Action* video games genre included *Counter-Strike: Global Offensive* played by 17 students, *Fortnite* and *PUBG*, each played by 9 students, *Standoff 2* played by four students, *Geometry Dash* played by three students, and *Apex Legends*, *Block Strike*, *Call of Duty*, *Friday Night Funkin'*, *Honkai Impact 3rd*, *Rust*, *Soul Knight*, *Tiles Hop: EDM Rush!*, each played by one student. *Sports* video games genre included *FIFA* played by 11 students, *Gran Turismo Sport*, some *racing games*, each played by two students, and *Dream League Soccer*, *football*, *Need for Speed*, *NHL*, some *sport*

games, each played by one student. *English language* test results showed a significant positive correlation with students living in cities (p=.042). Playing video games during weekdays had a statistically significant negative correlation with all three languages - *Russian as the first language* (p=.001), *Kazakh as the second language* (p=.000), and *English language* (p=.031). The analysis did not show any statistically significant effect of playing all video game genres, and students' gender on the *Language test* performance of Russian speaking students, which supported the null hypothesis.

Taken together, the results of the multiple regression modelling both rejected and supported the null hypothesis to the RQ3 (i.e., What effect does the students' video gaming behaviour have on their NIS selection test results for the sample?). Specifically, the null hypothesis was supported in the result of examining the impact of playing *Action-adventure*, *Adventure, Art*, *Endless runner*, *Logic*, *MMO*, *Party*, *Puzzle*, *Role-playing* video games genres, which did not demonstrate any statistically significant effect on students' NIS selection test results. Whereas, the null hypothesis was rejected by finding the statistically significant effect of playing *Action*, *Sandbox, Strategy*, *Sports*, *Simulation*, *Social deduction* video games genres as well as video gaming during weekdays and weekends on students' admission results.

Conclusion

In this chapter the findings of the descriptive analysis, independent *t*-test, and multiple regression analysis, performed on the dataset consisting of self-reported video gaming questionnaire responses and NIS selection test results of 255 candidates to enter NIS Grade seven were presented. The descriptive analysis showed that the sample students played 83 video games, which relate to 16 video game genres. The most popular video games were *Minecraft*, *Brawl Stars*, *Counter-Strike: Global Offensive*, *Roblox*, and *FIFA*. The independent *t*-test established a significant difference between the academic performance of the students from the sample and that of the whole population in almost all NIS selection test domains. The multiple regression modelling revealed statistically significant positive effects between time spent playing video

games during weekends and both *Mathematics* and *Quantitative Reasoning* scores, *Russian as the first* and *Kazakh as the second languages*, and *English* for Russian speakers, whereas a statistically significant negative effect was found between these subtests and playing video games by the same students during weekdays. Playing video games of *Strategy* and *Sandbox* genres revealed a statistically significant positive effect on the results of both *Mathematics* and *Quantitative Reasoning*. As for the *Language test* the most influential predictor of higher test performance was shown by playing *Strategy* video games genre, which had a statistically positive significance on *Kazakh as the first language*, and *Action* and *Sports* video game genres, which had a statistically positive significance on *Russian as the first language*. The next chapter presents the discussion of the obtained results in the present study.

Discussion

Introduction

This chapter provides an interpretation and discussion of the results of the quantitative analysis, performed to determine the effects of playing video games on students' NIS selection test results. In response to this research objective the following research questions and hypotheses were formulated:

RQ1: What video games and video game genres were the most popular for the sample of students during the months leading up to the NIS selection test?

Hypothesis 1: There were no popular video games and video game genres for the sample of students during the months leading up to the NIS selection test.

RQ2: How does the performance for each subject of the NIS selection test compare between the sample and the population of students?

Hypothesis 2: There is no difference between the performance of the sample and the population of students for each subject of the NIS selection test.

RQ3: What effect does the students' video gaming behaviour have on their NIS selection test results for the sample?

Hypothesis 3: Students' video gaming behaviour does not affect their performance on the NIS selection test.

The Most Popular Video Games and Video Game Genres among the NIS Candidates

Despite a great variety of video games available for children in Kazakhstan, *Minecraft* was the most popular video game among the NIS candidates, being the favourite for 42 students out of 255. This is not surprising, because according to numerous sources, *Minecraft* was released in 2011 and is still one of the most well-liked *Sandbox* video games in the world with 141 million players, and 200 million copies sold on the global market (Statista, 2021). Such amazing popularity of *Minecraft* can be explained by its open-world three-dimensional environment where players can create different things from small houses to big cities out of different kinds of blocks

representing organic and hand-crafted materials (Washington Post, n.d.). It is very simple to play this game because there are no long instructions explaining the gaming rules. However, players must use their imagination, memory, problem-solving skills, and perseverance in order to interact with the objects and create something in *Minecraft*. It is worth noting that there is much literature on using *Minecraft* in education, for example, teaching Mathematical concepts, in particular, algebraic patterns, measurement, perimeter, area, and volume, development of scientific literacy through functioning ecology of *Minecraft* with chemistry and physics law-ruled aspects (e.g., Bos et al., 2014; Short, 2012). Perhaps, this game is the top favourite among NIS applicants, because it suits players of all ages and does not have any violent contexts in-game scenarios, which is known by students' parents or guardians.

The second popular video game was *Brawl Stars*, which was indicated by 26 students from the sample. This game was released in 2018 and quickly became very popular in gaming communities with over 200 million downloads (Brawl Stars, 2022). *Brawl Stars* is considered to be part of the *Strategy* game genre and requires players to select an appropriate playing strategy for their chosen character, called Brawlers, which have different abilities, stats, and weapons (Filipowicz, 2017). Also, this game has four different modes of playing, which is very convenient for gamers, as it gives them an opportunity to try different styles of their favourite game.

Counter-Strike: Global Offensive or CS:GO was the third most popular game with 17 students playing it. *CS:GO* was released in 2012 and soon became one of the largest global eSports with a prize pool of US$1,000,000 for a winning team (Counter-Strike: Global Offensive, 2017). This game is part of the *Action* video game genre, where gamers play in a team of terrorists and counter-terrorists, which have to defuse the bomb planted by terrorists before it explodes. Players have various weapons and war outfits, they should communicate and employ various strategic movements in order to succeed (Chapman, n.d.).

Another interesting popular video game played by 14 students became *Roblox*, which is part of the *Role-playing* genre and is actually an online platform, which allows users to create their

own games by coding in the programming language Lua as well as play the games created by other users. This game received positive feedback from experts, who state that playing *Roblox* enhances creativity and develops players' trading skills, as players create various objects and can sell them to other players (Roblox, 2022). Considering these features of *Roblox*, we can assume that some of the NIS candidates preferred playing this game due to its innovative opportunity to create their own game rather than playing existing games with the prescribed rules.

These four games became the top favourites for 99 students out of 255 students during their preparation time to take the NIS selection test. Whereas the other 79 games were played by the remaining 156 students, which means that on average two students played the same game. These numbers show the great variety of existing games and the diverse gaming preferences of NIS applicants.

As for the 16 video game genres, which were determined on the basis of the 83 video games played by students, the *Action* games genre was the most popular genre with 51 students playing this video game genre. According to Wikipedia, the *Action* video game genre requires players to use their hand-eye coordination and motor skills to overcome physical challenges. This genre has eight subgenres and is still one of the most popular video game genres in the world (List of video game genres, 2022). It is worth noting, that only one out of four favourite video games among the students in the sample belonged to the *Action* genre, which is *Counter-Strike: Global Offensive* played by 17 students. It means that despite the popularity of *Minecraft* which was played by 42 students, the majority of students from the sample preferred to play *Action* video games, which corresponds to the global trend of the popularity of this video game genre in 2021 (Statista, 2022).

The next popular video game genre was *Sandbox* with 44 students playing it from the sample. This genre includes only two video games played by the students: *Minecraft* with 42 players and *Terraria* with two players. *Sandbox* video games are also called open-world games or software toys because players have the freedom to create whatever they want on the *Sandbox*

game platforms without the need to accomplish numerous goals. *Minecraft* is the most representative game of this *Sandbox* game genre (List of video game genres, 2022).

The *Strategy* video game genre was the third most popular genre, which was played by 41 students from the sample. This genre relates to games, where players in a team have to think strategically and make informed decisions to win the game in which confrontation takes place in different worlds or between two or more squads (List of video game genres, 2022). *Brawl Stars*, which was the second most popular video game for 26 students from the sample, belongs to the *Strategy* video game genre. However, the other 15 students played other strategic games, making this genre the third favourite for the sample of NIS candidates.

Overall, it is evident that the video gaming preferences of the sample of NIS applicants generally resembled the popular trends in the global video game community.

The Differences in NIS Selection Test Performance between the Students of the Sample and Population

The results of the quantitative analysis revealed a statistically significant difference between the results of the NIS selection test domains of 255 students from the sample and 17 664 students of the population. The test performance of the sample students appeared to be significantly higher than that of the population, except for *Kazakh as the second language*. This difference can be explained by the fact that 223 students from the sample (or 99%), achieved the threshold scores both in *Mathematics* and *Quantitative Reasoning*, which is obviously a much bigger proportion than in the overall testing population. The results of the effect-size analysis revealed a strong practical significance only for *Mathematics*, and *Quantitative Reasoning* scores for students with Kazakh and Russian languages of instruction, and *English* language scores for students with the Kazakh language of instruction. It means that the effect of video gaming on the results of these subtests discussed in the next section of this chapter may not be entirely relevant to the larger population in the real world. Medium practical significance was found for the results of *Russian language* scores as the first and second languages and *English* language for the students with the

Russian language of instruction. It means that the pragmatic utility of the effect of playing video games on students' selection test results on these subtests may only be relevant to higher academically performing students.

The difference in the test performance of the sample and population revealed that the sample does not fully reflect the population, its regions, languages, locality, gender, and other features. For example, the sample includes the students who applied to 10 NISs, while the population consists of applicants from 20 NISs. The students from the sample live in 14 regions of the country, while the living regions of the students from the population exceed this number considerably.

Another reason for the higher test outcomes of the students from the sample might be their higher level of motivation to be admitted to NIS, which drove them to take part in the NIS questionnaire on their video gaming behaviour. Presumably, students who desire to enter NIS are really interested in school life, they follow them on social media because they want to become a part of NIS in the future. Perhaps, some of the students thought that their participation in this survey would become beneficial for them, that's why they took the optional survey. Consequently, it can also be concluded that students who did not achieve the thresholds in *Mathematics* and *Quantitative Reasoning* to be admitted for consideration of the NIS scholarship or students who understood that their selection test results were not competitive enough, decided not to take part in the NIS questionnaire about their video gaming experiences, which resulted in the higher average test performance of the sample students of this study.

The Effects of Playing Video Games on the Students' NIS Selection Test Results

The multiple regression analysis determined statistically significant negative and positive effects as well as zero effect of playing video games on students' NIS selection test results on seven academic domains - *Mathematics*, *Quantitative Reasoning, Kazakh as the first and second languages*, *Russian as the first and second languages* and *English*. Video game genres and playing on weekdays and weekends were taken as predictors of students' test performance. This

section discusses how and why the played video game genres, playing days of the week, and students' gender and area of residence affected students' test results within the subtests of the NIS selection test.

The Effects of Video Game Genres on Mathematics Scores

It was found that playing *Sandbox* and *Strategy* video games predicted higher scores in *Mathematics.* Playing the *Social deduction* video game genre affected *Maths* test performance negatively, but this finding is based on only one respondent, therefore, can be considered negligible. No studies were found that examined the impact of *Sandbox* games on students' *Maths* achievement, however, there is numerous literature on employing *Sandbox's* most representative video game *Minecraft* in educational ways (Bos et al., 2014; Short, 2012; Sin et al., 2017). The creative open-world nature of *Sandbox* games allows players to construct a wide range of objects, structures, and even landscapes, using their spatial reasoning and problem-solving skills. Consequently, spatial reasoning skills were shown to be a strong predictor of performance in STEM in the result of a longitudinal study of 400 000 American students (Wai et al., 2009). Problem-solving skills are employed in almost all video game genres but are best developed in *Sandbox* games, where players are given a great degree of freedom to explore, create and tackle various construction problems according to the gameplay features using recalling and reasoning abilities as well as their own expertise and intuition (Granic et al., 2014). So, for example, in order to build a house, one player has to calculate the number of bricks necessary for constructing the walls, the floor, and the roof considering the desired size and form of the house. Thus, the positive effect of playing *Sandbox* games on *Mathematics* scores can be good supporting evidence of students' improved mathematical abilities through the enhancement of their spatial reasoning and problem-solving skills.

The *Strategy* game genre's influence on academic achievements was examined by Adachi and Willoughby (2013) who found a positive association. The scholars stated that strategic games develop players' computational skills, problem-solving skills, and reasoning speed because they

have to think up various action strategies, evaluate their success, and foresee the gaming strategy of an enemy in order to win the game (Adachi & Willoughby, 2013; Berland & Lee, 2011). This in turn might have a positive effect on players' cognitive thinking and accordingly on their academic performance in *Mathematics*, where they must solve various mathematical problems on the base of known mathematical concepts and rules. In both cases, students have to think, evaluate the pros and cons, and choose the correct way to win the game or solve the mathematical task. Thus, this study's findings support the effect of Strategy games on mathematical reasoning.

The Effects of Video Game Genres on the Quantitative Reasoning Scores

The analysis results of the effect of students' video gaming experiences on the *Quantitative Reasoning* subtest performance, which is an ability test for mathematical reasoning, revealed almost the same results as for *Mathematics*. The exception was the positive impact of playing *Simulation* video game genres on *QR* scores. The *Simulation* games require students to employ and develop their spatial reasoning skills, which were proved to be a strong predictor of performance in STEM (Wai et al., 2009). Moreover, considering the specific design of the *QR* test, which requires students to solve mathematical problems within a limited time, it can be assumed that by playing *Simulation* games students developed their ability to quickly identify and implement the best appropriate game tactics, which in turn helps them to solve the *QR* mathematical tasks quickly and successfully. In the reviewed literature, no data was found on the positive association between playing video games of the *Simulation* genre and *Quantitative Reasoning* test scores. Thus, this finding can be considered new in the body of relevant knowledge.

The analysis did not show any statistically significant effect of playing other video game genres (*Action, Action-adventure, Role-Playing, Puzzle, Sports, MMO, Adventure, Casual game, Endless runner, Logic game, Art game, Party game*) on *Mathematics* and *Quantitative Reasoning* tests scores. This finding supports and at the same time does not support the outcomes of Ventura et al., 2012, which found a negative effect of playing Shooter games and zero effect of playing

Fighting, Role-playing, Action-Adventure, Puzzle, Platformer on the undergraduate students' GPA. In the present study Shooter, Fighting, and Platformer games are referred to as the *Action* video games genre according to Wikipedia game classification (List of video game genres, 2022).

The Effects of Video Game Genres on Language Tests Scores

The effect of video game genres on students' *Language test* performance which assesses students' reading literacy in their first, second and third languages differs from mathematical test outcomes, except for the *Strategy* games genre, which became a good predictor for *Kazakh as the first language* results as well. Such a positive effect can be explained by the fact that Kazakh speaking students in order to play *Strategy* games had to read and get a good understanding of the game instructions, despite the fact that they are written in English and/or Russian languages. They most likely used the Kazakh language as it is their native language to communicate with other co-players, explaining their chosen gaming strategy, and giving details about the actions each team member had to make in order to win the game. Berland and Lee (2011) stated that playing *Strategy* games required players to internalise the compound written game instructions and externalise their desired strategic operations. Therefore, it might be assumed that players of *Strategy* games have higher reading and communication skills, which in turn may result in higher test performance in *Kazakh as the first language* domain.

Turning now to the discussion of the effects on Language tests for students, whose first language was Russian, it was an unanticipated outcome that *Strategy* video games did not predict their performance, but *Action* and *Sports* video games genres did. This inconsistency may be due to different game genre preferences of students with different native languages, which can also mean different cultures or mentalities. Nevertheless, researchers in the field claim that playing *Action* video games improves gamers' perceptual skills, attention, memory capacity, and higher cognitive functions (Green & Seitz, 2015). Therefore, it can be assumed that the NIS applicants performed better in *Russian as the first language*, reading texts, keeping in mind the peculiarities, and finding the correct answer to the questions. At the same time, no study was found examining

the effect of playing *Sports* video games on gamers' language test performance. However, the positive relationship between playing *Action* and *Sports* video games can be explained by the same language development principles which occurred in the Kazakh speaking students playing *Strategy* games. It can be assumed that the Russian speaking students who played *Action* and *Sports* games had higher reading literacy in their first language because they studied the game rules thoroughly and had to understand the game nuances in order to accomplish the set task. Moreover, these game genres are known for the constant creation of various missions for the players, among which reaching the point of destination in a limited time, defeating five enemies with particular weapons, gaining points by using complicated series of movements, etc. Therefore, it can be assumed that students' engagement with new instructional texts from game developers on a continuous basis contributed to the improvement of their reading comprehension.

Surprisingly, no statistically significant relationship was found between the 16 video game genres played by students with native *Kazakh and Russian languages* and their results in the *English* language subtest. This may be due to the fact that the *English* language is the third language for NIS candidates, therefore their reading literacy of English texts is expectedly lower than that of the first or second language. In addition, it might be that NIS applicants did not play games with English dubbing and written instructions, as their level of English proficiency at their age did not allow them to understand the logic of the game and became interested in playing it. It is worth noting that no studies were found, that examined the effect of video game genres on players' performance in English language reading literacy tests.

The Effects of Playing Video Games during Weekdays and Weekends on Mathematics, Quantitative Reasoning, and Language Tests Scores

Another predictor of students' results in NIS selection test domains in this study was playing games on weekdays and weekends. The analysis results showed that playing video games during weekdays negatively affected *Mathematics* and *Quantitative Reasoning* scores for students with Kazakh and Russian languages of instruction as well as *Language tests* scores for students

with Russian as the first language. Whereas gaming during weekends appeared to have a significant positive association with these academic domains for the same students. However, surprisingly, no effect of gaming during weekdays and weekends was established on Language tests scores for students with Kazakh as the first language.

Considering the conflicting evidence on the effects of gaming on weekdays and weekends on gamers' academic outcomes, it is difficult to connect the findings of the current research to specific separate sources. So, for example, the findings are consistent with the results of the study of Islam et al. (2020), who identified the positive effect of 11-17 years-old students' gaming during weekends on their standardised NAPLAN reading scores in Australia as well as the study of Sharif and Sargent (2006), which determined negative relations of gaming during weekdays on Grades 5-8 students' GPA. However, the positive effect of playing games during weekends on *Mathematics* is not consistent with the findings of zero effect of weekend gaming on NAPLAN numeracy scores (Islam et al., 2020). At the same time, the present study does not support the findings of the following studies: Dindar (2018) and Skoric et al. (2009), who found no effect of video gaming during weekdays and weekends on GPA and teacher-reported Mathematics and Science grades, Skoric et al. (2009) and Islam et al. (2020), who found a positive effect of video gaming during weekdays on students' English test scores, collected from their school teachers, and NAPLAN reading scores. However, such an effect could occur because GPA and school grades do not represent standardised assessment outcomes but school teachers' evaluation of students' performance, which can be regarded bias. As a result, the findings of the present study corroborate both kinds of studies which found negative, positive, and no relationships between the time spent playing video games and students' academic performance. However, no studies were found, that determined the negative effect of playing games during weekends, but there are numerous researches that revealed the negative academic consequences of excessive playing throughout the whole week and addiction to video games (Anderson et al., 2007; Anderson & Dill, 2000; Islam et al., 2020; Rehbein et al., 2010).

Therefore, the findings of the present study can be explained in the following way. Students who played during weekdays and had lower results in *Maths, QR, Russian as the first, Kazakh as the second,* and *English languages* probably spent less time studying and doing activities, which might have improved their test performance, specifically, sleeping, physical exercising, outdoor plays, etc. Furthermore, it can be suspected that they also suffered from gaming addiction, which can lead to truancy, demotivation to learn, devotion less time for studying, and diminished school performance (Anand, 2007; Ferguson, 2015; Granic et al., 2014; Gentile, 2009; Islam et al., 2020). On the contrary, students who played on Saturdays and Sundays experienced positive consequences on their results in *Maths, QR, Russian as the first, Kazakh as the second,* and *English languages*, probably because they could receive qualitative rest, stress relief, and joy through playing games on weekends. This in turn provided them with the necessary break from their routinely hectic weekdays after and before their constant preparation for the high-stakes NIS selection test. Also, on weekends students have more free time from their studies, therefore they are able to invite their friends and immerse themselves together in the amusing world of games without feeling tired or guilty. As a result, students experience a feeling of happiness and satisfaction, as well as an emotional motivation to keep studying after the end of their weekends. Zero effect of gaming during weekdays and weekends on Language tests scores of students with Kazakh as the first language may be explained by the fact that Kazakh students in total played less than Russian students during both weekdays and weekends, which might have resulted in no effect in the statistical analysis.

The Relations between Students' Gender and Area of Residence and their Scores in Mathematics, Quantitative Reasoning, and Language Tests

The current study also found statistically significant correlations between students' gender and area of residence and their selection test results. So, male students scored better in *Mathematics* and *Quantitative Reasoning*, while female students with native Kazakh language showed better results in *Kazakh as the first* and *English languages*. However, PISA 2018 revealed

that there were no significant differences between Kazakhstani boys and girls' performance in Mathematics, whereas girls outperformed boys greatly in reading (OECD, 2019). The former inconsistency in boys' Mathematics performance might be explained by their higher motivation to achieve better scores in *Mathematics* on the NIS selection test than to receive higher scores in PISA. The finding on the Kazakh-speaking female students performing better in *Kazakh* and *English* is also not surprising, considering no effect on their Russian as the second language scores. The possible explanation can be the fact that they did not prepare additionally to take this test, as they used the Russian language at a conversational level. Furthermore, no association with females with native Russian language might be explained by the fact that these girls had lower motivation to be admitted to NIS because they knew that the number of vacant places for Russian classes is considerably lower in most cities of Kazakhstan due to the Kazakh-prevalence population in the country (2020 Annual Report of the Autonomous Educational Organization "Nazarbayev Intellectual Schools", 2021).

If we now turn to the discussion of the effects of students' living areas (*urban* and *rural*) on their selection test results, important and reality reflecting outcomes were evident. So, *urban* students had a great advantage over *rural* students in most selection test domains: *Mathematics, Quantitative Reasoning, Russian as the first language, Kazakh as the second language,* and *English* for students with native Kazakh and Russian languages. Whereas, no effect was determined on *Kazakh as the first* and *Russian as the second languages*. These outcomes can speak about the better educational opportunities in cities of Kazakhstan, where students are taught in schools equipped by pedagogical cadres with higher professional mastery than in rural areas of our country. The quality of urban and rural education was discussed by Sarsembayeva (2020), who states that urban schools have great advantages over rural schools in terms of proper technical equipment, availability of new textbooks, and student funding, which directly affect the quality of educational services and knowledge acquisition by students.

The results of the present study supported the conceptual framework of the current study in terms of the existence of positive, negative, and zero effects of video gaming on students' performance in the NIS selection test domains. However, the reasons for these effects described in the reviewed literature and discussed by the present study differed. Therefore, the present study conceptualises that the negative effect of playing video games can occur due to playing on weekdays. Whereas, the positive effects can happen due to playing *Sandbox*, *Strategy*, *Simulation* video games genres and gaming during weekends. Zero effect can be observed while playing any other video game genre.

Conclusion

The present chapter discussed both positive, negative, and zero effects of playing video games on students' performance in the NIS high-stake selection test, which consisted of *Mathematics, Quantitative Reasoning, Kazakh as the first and second languages, Russian as the first and second languages,* and *English language*. Positive effects were found between playing video games of *Sandbox, Strategy* and *Simulation* genres and *Mathematics* and *Quantitative Reasoning*; *Strategy* games and *Kazakh as the first language* tests; *Action* and *Sports* games genre and *Russian as the first language* tests. These positive impacts on students' selection test performance may be explained by the employment of strategic thinking, spatial reasoning skills, computational thinking, and problem-solving skills, which develop students' cognitive thinking as well as reaction, attention, and memory capacity. Playing during weekends also revealed a positive influence on students' scores in *Mathematics, Quantitative Reasoning* with Kazakh and Russian mediums, and Language tests for students with Russian language instruction. Such optimistic findings may be explained by the fact that students received a qualitative rest from stressful schooldays by playing their favourite video games and getting the necessary reboots and motivation to continue preparation for the NIS admission test. Negative effects were determined between playing during weekdays and Language tests for students with Russian language instruction. The adverse influence of playing during weekdays may indicate the ineffective time-

management of students: they might not spend enough time studying and doing other extracurricular activities, which might improve their test results. These findings can be considered relatively new to the current state of knowledge, as no studies were found that examined the video gaming effects on high-stake standardised admission tests to enter secondary schools in the world or in Kazakhstan. Together, these findings provided important insights into the impact of playing video games by students on their performance in seven academic domains of the NIS selection test. The next chapter concludes the present paper by providing information about the theoretical and practical implications, limitations of this study, and important recommendations for the interested stakeholders.

Conclusion

Introduction

The present chapter concludes this study, which was designed to determine the effect of playing video games on students' selection test results to enter Grade seven of Nazarbayev Intellectual schools, which consists of seven academic domains: *Mathematics, Quantitative Reasoning, Kazakh as the first and second languages, Russian as the first* and *second languages, English*. This chapter begins with the summary of key findings, derived by means of statistical analysis, in terms of three research questions and hypotheses. The next section discusses the existing limitations of the current investigation. Then important theoretical and practical implications of the current study outcomes as well as recommendations for the interested stakeholders are given in the following sections of this chapter.

Summary of Research Findings

This section summarises the major findings of three research questions, posed to determine the effect of playing video games on students' selection test results to enter NIS.

RQ1: What video games and video game genres were the most popular for the sample of students during the months leading up to the NIS selection test?

The frequency analysis showed that 255 NIS applicants played 83 video games, which refer to 16 video game genres. The most favourite video games of students were *Minecraft, Brawl Stars, Counter-Strike: Global Offensive, and Roblox, which relate to Sandbox, Strategy, Action,* and *Role-playing* video game genres respectively. The analysis of the most popular genres of video games demonstrated that students mostly played video games of the *Action, Sandbox, Strategy* genres, listed in the decreasing order of their popularity among NIS candidates.

RQ2: How does the performance for each subject of the NIS selection test compare between the sample and the population of students?

Common independent sample *t*-tests revealed that the academic performance of the sample students in NIS admission examination subjects was considerably higher than the population's

general test outcomes except for *Kazakh as the second language*. At the same time, Cohen's *d* effect-size analysis determined a strong practical significance only for *Mathematics,* and *Quantitative Reasoning* scores for students with Kazakh and Russian languages of instruction, and *English language* scores for students with the Kazakh language of instruction. These findings suggested that the effect of video gaming on these subtests' results may not relate to the entire population of NIS candidates.

RQ3: What effect does the students' video gaming behaviour have on their NIS selection test results for the sample?

Multiple regression analysis revealed positive, negative, and zero effects of students' video gaming behaviour on their NIS selection test results. The results of this investigation showed that playing video games of the *Sandbox, Strategy,* and *Simulation* genres, which develop students' cognitive abilities through the improvement of their spatial reasoning, problem-solving skills, and computational thinking, are considered to be an important factor for predicting higher scores in *Mathematics* and *Quantitative Reasoning*. Playing *Strategy* games became a strong predictor for *Kazakh as the first language*, whereas playing *Action* and *Sports* video games predicted higher performance in *Russian as the first language*. These effects might be explained by the development of students' perceptual skills, attention, and memory capacity, which contributed to the advancement of their reading literacy in their first languages. Contrary to expectation, this study did not find any effect of playing the 16 video game genres on *English* test scores for students with both Kazakh and Russian first languages. Another interesting finding of the current research was the negative influence of playing games on weekdays along with the positive influence of playing on weekends on the scores of *Mathematics, Quantitative Reasoning,* and *Language tests* for students with Russian as their first language. Such effects might be explained by spending less time on weekdays for extracurricular activities, which could boost academic performance, and having qualitative rest, stress relief, and joy of play during weekends.

Limitations of the Study

Several limitations of the present study need to be acknowledged. First, no studies were found related to the examination of video game effects on students' performance on standardised admission examinations to enter specialised selective secondary schools, which could be used for guidance in the present study. Therefore, the findings of this study were compared with the outcomes of other research on the video game effects on standardised low-stakes monitoring tests, in which participants were probably less motivated to achieve high results as well as other more subjective variables like class scores and GPA.

Second, the sample size was relatively small compared to the population of NIS candidates and the population of Grade six students in Kazakhstan as well as nonhomogeneous, with a large proportion of the sample students with high test performance from half of the total number of the regions with NISs. Therefore, the generalisability of the results of this study is subject to certain limitations. Specifically, the effects of playing video games discussed in this paper might not be transferable to the performance of students with lower academic progress in Russian as the first and second languages, and English language in Russian classes.

Third, out of 16 video game genres played by the sample of 255 students, six video game genres were played by only one and two students each, which limited the proper determinations of their effects on students' test performance. For example, statistically significant negative effect was identified between the Social deduction game genre and both Mathematics and Quantitative Reasoning scores, whereas only one student from the sample played the game of this genre.

Finally, the study is limited by the lack of information on other factors, for example, the amount of time spent playing particular video games on weekdays and weekends, and the level of student's current academic performance in school within the subjects of the NIS selection test. This information could provide more accurate results on the video gaming effects on students' selection test performance.

Implications and Recommendations

Theoretical Implications

The results of the current study have important theoretical and practical implications for the existing body of knowledge and practice in this area. First of all, as no study was found that investigated the effects of video gameplay on students' standardised admission test results to selective secondary schools, it is important to note that the current research could rectify this knowledge gap in the existing body of knowledge. Specifically, it provides sound information about how specific video game genres and playing during weekdays versus weekends impact the entrance test performance of Grade six students aged 12-14. More importantly, it reports the positive, negative, and zero video gaming consequences on the students' results in numeracy and reading literacy tests in first, second, and third languages in the form of standardised assessment. Secondly, considering the ongoing debates about the effects of video gaming on students' academic performance in both objective and standardised assessments, the findings of the present study can be considered an informative contribution to the existing controversial theory. Therefore, the results of the present study can be of interest to a broad range of scholars in the field of education, politics, computer science, child psychology, health, and even commercial video game institutions.

Practical Implications

Concurrently, the following practical implications can be derived from the results of the present study, which may be addressed by parents, teachers, students' guardians, policymakers, and child psychologists. Firstly, it indicates that recreational video gaming does not always impair students' achievements in high-stake examinations to enter specialised selective secondary school. Secondly, it points to the importance of monitoring the video game preferences of students during the period of preparation for the exams by the interested parties. This way it can be ensured that students play video games, which would positively affect their test performance. Thirdly, interested parties may also control students' video gaming behaviour, prohibiting playing

on weekdays and allowing playing during weekends, to achieve better results in standardised selection tests. However, the generalisability of the current research is problematic, as the video gaming effects may be relevant only to higher-performing students in the larger population.

Recommendations

An implication of these findings is that both video game genres and gaming days should be taken into account while making recommendations to an existing policy, practice, and future research in terms of video gaming behaviour of students aiming to enter specialised secondary schools like NISs.

Recommendations for Policy Makers. The findings of the present study suggested several courses of action for policymakers, which are responsible for the development and implementation of the proper documents for the regulation of adolescents' video gaming behaviour. Thus, it is advised that relevant legal bodies design a social project, which will be aimed at enhancing Kazakhstani citizens' awareness of video gaming's effects on the academic performance of secondary students in the context of Kazakhstan. This project may include three stages. In the first stage, relevant information on Kazakhstani pupils can be gathered and analysed, which can serve as a basis for the development of thorough information and recommendations on students' video gaming behaviour in the second stage of the social project. Finally, the third stage may be the dissemination of these recommendations to the relevant educational, psychological, medical, and video game design institutions as well as citizens of our country in order to ensure that all interested stakeholders are informed about this policy. Besides, Nazarbayev Intellectual schools being the autonomous educational organisation may make use of the findings of the present study and inform the parental community about the possible effects of video gaming on their children's performance on the NIS selection test.

Recommendations for Parents and Guardians. The outcomes of this study can be used to develop informative recommendations for parents and guardians of those students, who plan to compete for a placement in selective secondary schools like NISs. First of all, it can be recommended that parents do not restrict their child to play video games at all, but search for the appropriate video game among the genres, which revealed a positive effect on selection test domains. Secondly, it can be advised that parents restrict their children from playing any kind of video games on weekdays, so students can be more focused on their studies, physical exercises, rest, and sleep. Thirdly, it would be helpful if parents create comfortable conditions for their children to play video games on weekends to provide their child the necessary break, relaxation, and communication with friends, which might boost their motivation for further studies. Yet, it is not recommended to follow the above advice if students' current academic performance in NIS selection test subjects is not strong and high, as the results of this study may not be relevant to the larger population.

Recommendations for Future Research. The issue of video gaming's effects on students' academic performance is an intriguing one that could be usefully explored in further research. So, further investigations may be conducted with a bigger sample size that includes students of all abilities from all regions of Kazakhstan, where NISs are situated. Also, other independent variables could be included, in particular, SES, the starting age of playing, time spent playing particular video games during a day/week/month/year, the total hours of playing, the favourite mode of playing as well as qualitative information about students' attitudes to video games, their self-evaluation, intrinsic motivation to play certain games, parents' perception and many other factors, which may contribute to the deeper examination of the effect of video game experiences on academic achievements. It is suggested that the association of these factors is investigated in future studies.

From the findings of the present study, we know that different video game genres have different effects on different subjects. Therefore, further research is needed, that concentrates on

the investigation of the effects of playing a particular video game on the students' performance in a particular subject considering that every subject might require different cognitive operations, skills, and abilities. Moreover, it is recommended to utilise standardised test results in examining the video gaming effects, instead of the cumulative GPA or grades, reported by students, teachers, and parents accounting for their bias and inability to compare the findings in multiple research.

Conclusion

Considering the broad popularity of video games as the favourite pastime of children, the present study was aimed at determining whether students' video gaming has any effects on their performance in highly competitive selection tests of NIS. This is the first study that posed this question in the pursuit to establish whether there were significant negative or positive effects on students' outcomes in the standardised tests which should be addressed. In general, taking into account the key findings of this study it can be assumed that the research purpose was achieved to some extent. The present study was guided by research questions, developed for gradual uncover of useful information, and statistical analysis with the aim to receive accurate results which reflect the real state of affairs. The chosen methodology allowed us to answer the research questions, taking into account the nature of numerical and categorical data on students' gaming experiences and test performance. Overall, the author is satisfied with the outcomes of the conducted research, because they are new, interesting, actual and to some extent disprove some preconceived notions about playing video games.

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Appendix A

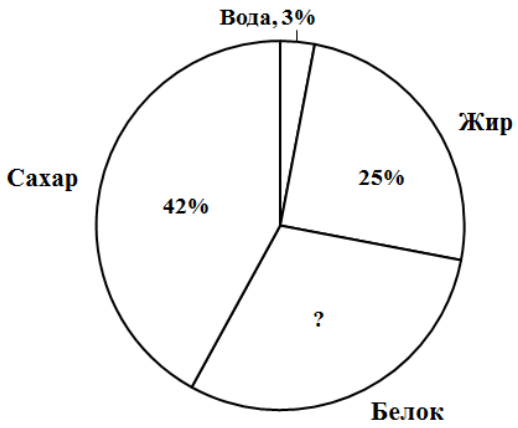
Examples of Selection Test Items to Enter Grade 7 of Nazarbayev Intellectual Schools

Mathematics

This section of the test measures how well students can solve mathematical problems. There is only one correct answer to the questions.

Sample item for students with Russian mode of instruction:

Сухое молоко содержит жир, белок, сахар и воду. Их соотношение представлено в виде диаграммы. Сколько граммов белка содержится в 1 килограмме сухого молока?



A) 0,3

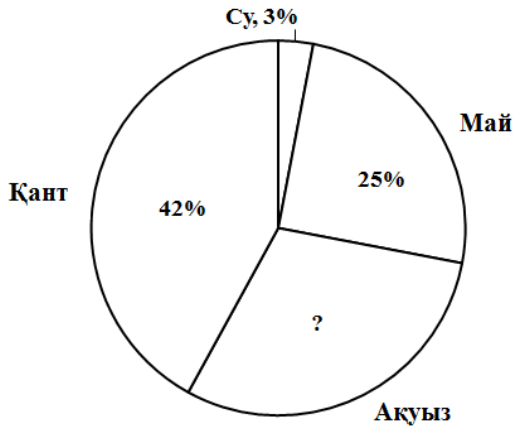
B) 3

C) 30

D) 300

Sample item for students with Kazakh mode of instruction:

Құрғақ сүттің құрамында май, ақуыз, қант және су бар. Олардың қатынастары диаграмма түрінде көрсетілген. 1 килограмм құрғақ сүттің құрамында қанша грамм ақуыз бар?



A) 0,3

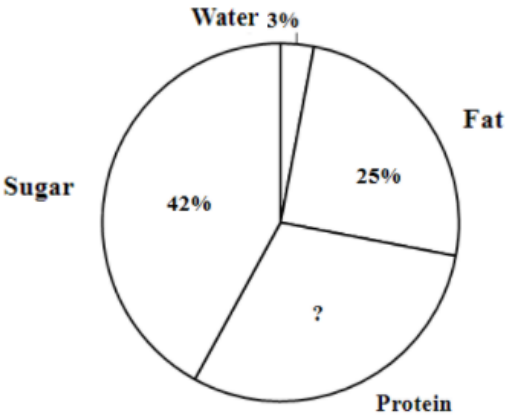
B) 3

C) 30

D) 300

Sample item translated into English language:

Milk powder contains fat, protein, sugar and water. Their relationship is presented in the form of a diagram. How many grams of protein are in 1 kilogram of milk powder?



A) 0,3

B) 3

C) 30

D) 300

Quantitative Reasoning

This section of the test measures how well students work with numbers in the limited time. Each question consists of two parts. The first part is located in column A. The second part is located in column B.

Students need to determine in which column the value is greater, whether the values in both columns are equal or insufficient information. Choose the answer:

A, if the value in column A is greater.

B, if the value in column B is greater.

C, if both values are equal to each other.

D, if there is not enough information.

Sample item for students with Russian mode of instruction:

Column A	Column B
. $(35 \cdot 50)$	$(35 \cdot 5) + (35 \cdot 10)$

Sample item for students with Kazakh mode of instruction:

А қатары	В қатары
$(35 \cdot 50)$	$(35 \cdot 5) + (35 \cdot 10)$

Sample item translated into English language:

А қатары	В қатары
$(35 \cdot 50)$	$(35 \cdot 5) + (35 \cdot 10)$

Kazakh as a first language

Қоқыс дерті – ғасыр мәселесі

1. Қай қаланың шынайы келбетін көргіңіз келсе, ең бірінші сол қала маңындағы күл-қоқысқа мән бергеніңіз жөн. Қазіргі таңда бұл басты мәселенің біріне айналды. Бүгінде республика аумағында 43 миллиард тоннадан астам қоқыс жинақталған. Оның тек 5 пайызы ғана кәдеге жараса, қалғаны жер қойнауына жіберіліп, одан әрісі қауіпті үйінділердің маңына төгіледі. Қазіргі уақытта тұрмыстық қалдықтарды жинау, сақтау және өңдеу мәселесі ұзақ жылдар бойы өзекті жағдайдың қатарында тұр.

2. Қоқыс полигондарының жетіспеушілігінен, оның сыйымдылығына шыдамай, күн сайын қоқыс қалдықтарының саны өсуде. Мынаны қараңыз, адамдар күн сайын тау-тау қылып күл-қоқысқа тастайтын пластмасса құтылар жер бетінде 500 жылға дейін, кәдімгі полиэтилен пакеттері 200 жылдан астам уақыт бойы шірімей, жатып алады екен. Ал консерві қалбырлары мен шыны сынықтары 1 мың жылға дейін жер қойнын ластап, топырақ құнарын жеп жатады. Тау-тау болып үйілген қалдықтардың экологияға кері әсер ететіні белгілі. Дәлірек айтқанда, бүлінген заттар топырақтың құнарын кемітіп, улы газдар арқылы ауаны ластайды. Оны өртесе, адам ағзасына зиянды заттар бөлінеді. Сол секілді басқа да қоқыс қалдығы адамға, ауаға, қоршаған ортаға кері әсерін тигізуде.

3. Қаланың әдемі келбеті, әсіресе, тазалығы табалдырығынан басталған халықтың мәдениетімен тығыз байланысты. Ал, мәдениет бар жерде қалаға деген жанашырлық, сүйіспеншілік те бар. «Тазалық – иманның жартысы» демекші, адамдар тазалыққа ортақ жауапкершілікпен қараса дұрыс болар еді! Қай уақытта да өмір сүріп жүрген ортамызды таза ұстау, Жер-Анаға қиянат жасамау адамзаттың қолында. Ендеше, қаламызды күл-қоқыстан таза ұстайық, ағайын!

1. Мәтіннің құрылымы бойынша ақпарат қалай берілген?

A) Салдары – себебі – ұсынысы

B) Ақпарат – статистика – дәлелі

C) Мәселе – салдары – ұсыныс

D) Статистика – деректер – мысалы

2. Мәтіннің екінші бөлімінен қандай ақпарат білдіңіз?

A) қалдықтарды жинау, өңдеу мәселесі туралы

B) қоқыс қалдықтарын пайдаға жарату туралы

C) қоқыстың қоршаған ортаға зияны туралы

D) тазалық сақтауға жауапкершілікпен қарау туралы

3. Мәтіннің соңғы бөлігінде автор не айтқысы келді?

A) Тұрғындарды қоқысты өңдеуге шақырады.

B) Тұрғындарды тазалықты сақтауға шақырады.

C) Тұрғындарды еңбектенуге шақырады.

D) Тұрғындарды ұйымшыл болуға шақырады.

Russian as the second language

Абулхаир хан

Несомненно, к числу выдающихся государственных деятелей Казахстана принадлежит хан Младшего жуза Абулхаир (1693 – 1748 г.г.), который является родоначальником российско-казахстанской дружбы.

В 1719 году он был избран старшим казахским ханом. Ханскую власть Абулхаир получил не по наследству, а благодаря выдающимся личностным качествам, присущим исключительно людям одаренным, отмеченным «рукой Бога». Такое в истории казахского народа случалось крайне редко.

По традиции в те времена ханская власть передавалась по наследству. Такое положение нередко приводило к расшатыванию общества, ослаблению обороноспособности страны, что помогало внешним врагам нападать и легко захватывать казахские земли.

1. «Такое положение» (последний абзац). Какое положение имеется в виду?

A) Власть передается от отца к сыну.

B) Власть получают способные люди.

C) Нападение врагов.

D) Ослабление страны.

Russian as the first language

Не так давно учёные из университета Хэриот-Уотт в Эдинбурге во главе с профессором Адрианом Нортом решили проверить связь музыкальных предпочтений с интеллектом и характером слушателей.

В ходе исследования ученые опросили 36 тысяч человек из разных стран мира. Ученые задавались целью доказать подросткам, что слушать тяжелую музыку и рэп небезопасно для их мозга, но результаты их _2_ .

«Один из фактов, который поразил нас больше всего, – это то, что поклонники классической музыки и тяжёлого рока очень похожи», – признался Адриан Норт. Они продемонстрировали наиболее высокий интеллект. «В обществе бытует стереотип поклонника тяжёлого рока как человека, находящегося в глубокой депрессии, и как опасного элемента общества. На самом деле это безобидные и очень тонкие натуры».

Впрочем, как показывает жизнь, во взрослом возрасте многие рокеры приобщаются к классическим произведениям, притом не отказываясь и от любимого металла. Неудивительно, что характеристики поклонников обоих жанров оказались схожи. «И те, и другие – личности творческие, непринуждённые, но не очень общительные», – заявил Норт.

Любители рэпа, хип-хопа и r’n'b показали самые низкие результаты IQ-тестов. Зато они, как и поклонники рэгги, продемонстрировали высокую самооценку и коммуникабельность. Самыми креативными оказались поклонники блюза и джаза, а также знатоки оперы. А наиболее трудолюбивыми были признаны любители кантри и поп-музыки.

1. Какие из утверждений верны согласно тексту?

1. Рокеры и любители классической музыки слегка замкнутые люди.
2. Поклонники рэпа и рэгги – общительные люди.

A) только первое

B) только второе

C) и первое, и второе

D) ни первое, ни второе

2. Какое слово лучше всего вставить вместо пропуска во втором абзаце?

A) возмутили

B) обрадовали

C) разочаровали

D) удивили

3. Что автор хотел сказать этим текстом?

A) Доброта – характерная черта рокера.

B) Не стоит доверять стереотипам.

C) Поп-музыка развивает трудолюбие.

D) Тяжёлый рок влияет на психику.

Kazakh as the second language

Осыдан біраз жыл бұрын ақпараттық кеңістікте «индиго балалар» деген термин пайда болды. Индиго балалар ешкімге ұқсамайтын көк түсті аура шашып тұрады және оны тек қана экстрасенсорлық қабілеті бар адамдар ғана көре алатын көрінеді.

Индиго балалардың немесе вундеркинд балалардың өзгелерге ұқсамайтын ерекшелігі – мінез-құлықтары ауырлау, тіл алмайтын, ренжігіш болып келеді екен, бірақ осыған қарамастан керемет талантқа ие.

Шын мәнінде солай ма?

Шындығына келгенде, дүниеге келген баланың бәрі «индиго» бола алады. Әрбір баланың талантты болып жетілуіне мүмкіндік бар. Яғни, бәрі бірдей мүмкіндікке ие.

Психологтардың айтуынша, индиго немесе вундеркинд балалар туыла сала, осы қасиеттерге ие екендігін көрсетуге мүмкіндіктері жоқ. Осы талантты, потенциалды ашуда ата-ана рөлі үлкен маңызға ие.

1. Қандай балалардың «индиго» болуына мүмкіндігі бар?

A) Ешкімге ұқсамайтын балалардың

B) Мінездері ауырлау балалардың

C) Біреуге өкпелегіш балалардың

D) Өмірге келген кез келген баланың

English language

A “Hoppy” Discovery

A new frog species has been discovered in New York City

1. Usually, scientists search rainforests, ocean habitats, or other places on Earth to find new plant and animal species. So, when a new type of frog was found hopping around New York, you could say, scientists were very happy.

2. Three years ago, science student Feinberg trekked around New York listening for the sounds and collecting strange frogs. He shared his research with biologist Catherine E. Newman who was studying leopard frogs. She analysed the code of the frog’s blood and compared the new frog’s blood structure with those of the leopard frogs. The frogs looked nearly identical, but their blood structure was very different.

3. Feinberg believes the frog also once lived in Manhattan, but its present habitat varies from the Great Swamp National Wildlife Refuge in New Jersey to northern counties of New York. It may even be living in parts of Connecticut and Pennsylvania. The centre of the frog’s habitat seems to be Yankee Stadium. _3_ Feinberg hasn’t found any frogs living around the famous baseball field.

1. What is the function of paragraph 1?

The author wants

A) to describe different habitats of animals and plants.

B) to draw attention to an unusual discovery in the USA.

C) to make a joke about American scientists.

2. What makes the new frog type different from leopard frogs? (Paragraph 2)

A) Its blood structure

B) Its present habitat

C) Its strange appearance

3. Which word/words is/are missing in paragraph 3?

A) But so far

B) Moreover

C) Therefore

Appendix B

Questionnaire for NIS Applicants to Enter Grade 7 Starting 2021-2022 Academic Year

Table B1

In original Kazakh language:

#	Сұрақтар	Жауаптар									
1	*12 саннан тұратын жеке сәйкестендіру нөміріңізді жазыңыз.*										
2	*НЗМ конкурстық іріктеуіне дейін бейнеойындарды ойнадыңыз ба?*	Ия						Жоқ			
	Бейнеойындардың қай жанрын ұнатып ойнадыңыз?	Атыс	Шытырман оқиғалы		Стратегия лық		Бас қатырғыш		Спорттық		
3	*Ең жақсы көретін бейнеойыннан (1) бастап онша ұнатпайтын бейнеойынға (5) дейін нөмірлеңіз.*										
4	*Өзіңіздің жақсы көретін бейнеойыныңыз болды ма?*	Ия			Жоқ			Бейнеойын ойнаған жоқпын			
5	*Конкурстық іріктеуге қатысқанға дейін ойнаған әрі жақсы көретін бір немесе екі бейнеойынның атауын жазыңыз.*										
6	*Жұмыс күндері тәулігіне неше сағат бейнеойын ойнауға жұмсадыңыз?*	0 сағат	1 сағат	2 сағат	3 сағат	4 сағат	5 сағат	6 сағат	7 сағат	8 сағат	9 сағат	10 сағат
7	*Демалыс күндері тәулігіне неше сағат бейнеойын ойнауға жұмсадыңыз?*	0 сағат	1 сағат	2 сағат	3 сағат	4 сағат	5 сағат	6 сағат	7 сағат	8 сағат	9 сағат	10 сағат

Table B2

In original Russian language:

#	Вопросы	Варианты ответов	
1	*Напишите свой 12-значный индивидуальный идентификационный номер*		
2	*Играли ли Вы в видеоигры до сдачи тестов конкурсного отбора в НИШ?*	Да	Нет

	Какого жанра видеоигры Вам нравилось играть? Пронумеруйте жанры видеоигр с самого любимого (1) до самого нелюбимого (5).	Шутерские	Приключенческие			Стратегические		Головоломки			Спортивные	
3												
4	У Вас была любимая видеоигра?	Да				Нет				Я не играл(-а) в видеоигры		
5	Напишите название одной или двух видеоигр, в которые Вы любили играть до участия в конкурсном отборе.											
6	*Сколько часов в день Вы играли в видеоигры в будние дни?*	0 часов	1 час	2 часа	3 часа	4 часа	5 часов	6 часов	7 часов	8 часов	9 часов	10 часов
7	Сколько часов в день Вы играли в видеоигры в выходные дни?	0 часов	1 час	2 часа	3 часа	4 часа	5 часов	6 часов	7 часов	8 часов	9 часов	10 часов

Table B3

In translation into English language:

#	**Questions**	**Alternatives**										
1	Write down your 12-digit individual identification number.											
2	Did you play video games before the NIS selection test?	Yes						No				
	What video game genres did you like playing? Order video game genres from the most favourite (1) to the least (5).	Shooter	Adventure			Strategic		Puzzle			Sport	
3												
4	Did you have your favourite video game?	Yes				No				I did not play video games		
5	Name one or two of your favourite video games you played before the NIS selection test?											
6	How much time in hours did you spend playing video games every day during weekdays?	0 hour	1 hour	2 hours	3 hours	4 hours	5 hours	6 hours	7 hours	8 hours	9 hours	10 hours
7	How much time in hours did you spend playing video games every day during the weekend?	0 hour	1 hour	2 hours	3 hours	4 hours	5 hours	6 hours	7 hours	8 hours	9 hours	10 hours

Appendix C

Frequency Table of Video Games within their Genres

Played by the Sample of NIS Candidates

#	Video games	Frequency	Percentage	Video game genres
1	Minecraft	42	16.5%	Sandbox
2	Brawl Stars	26	10.2%	Strategy
3	Counter-Strike: Global Offensive	17	6.7%	Action
4	Roblox	14	5.5%	Role-playing
5	FIFA	11	4.3%	Sports
6	Fortnite	9	3.5%	Action
7	Genshin impact	9	3.5%	Role-playing
8	PUBG	9	3.5%	Action
9	Puzzle	8	3.1%	Puzzle
10	Free Fire	7	2.7%	Role-playing
11	World of Tanks	6	2.4%	MMO
12	Chess.com	5	2.0%	Puzzle
13	Mortal Kombat	4	1.6%	Action-adventure
14	Standoff 2	4	1.6%	Action
15	Geometry Dash	3	1.2%	Action
16	Grand Theft Auto	3	1.2%	Action-adventure
17	Brain out	2	0.8%	MMO
18	Clash Royale	2	0.8%	Strategy
19	Cross-word puzzle	2	0.8%	Puzzle
20	Dota	2	0.8%	Strategy
21	Easy Game	2	0.8%	Puzzle
22	Gran Turismo Sport	2	0.8%	Sports
23	League of Legends	2	0.8%	Strategy

24	racing	2	0.8%	Sports
25	strategic	2	0.8%	Strategy
26	Terraria	2	0.8%	Sandbox
27	The Sims 4	2	0.8%	Simulation
28	100 Doors	1	0.4%	Puzzle
29	4 pics 1 word	1	0.4%	Puzzle
30	Among Us	1	0.4%	Social deduction
31	Angry Birds	1	0.4%	Puzzle
32	Apex Legends	1	0.4%	Action
33	ARK: Survival Evolved	1	0.4%	Action-adventure
34	BanG Dream! Girls Band Party!	1	0.4%	Adventure
35	Barvicha	1	0.4%	Simulation
36	Block Strike	1	0.4%	Action
37	Call of Duty	1	0.4%	Action
38	Checkers	1	0.4%	Strategy
39	Civilization	1	0.4%	Strategy
40	Clash of Clans	1	0.4%	Strategy
41	CodyCross	1	0.4%	Puzzle
42	Crossout	1	0.4%	MMO
43	Dragon Mania Legends	1	0.4%	Casual
44	drawing	1	0.4%	Art
45	Dream League Soccer	1	0.4%	Sports
46	Field of dreams	1	0.4%	Puzzle
47	football	1	0.4%	Sports
48	Friday Night Funkin’	1	0.4%	Action
49	Gacha Life	1	0.4	Role-playing
50	Hearts of Iron IV	1	0.4	Strategy
51	Honkai Impact 3rd	1	0.4	Action

52	Intellect battle	1	0.4	Logic
53	Jurassic World Evolution	1	0.4	Simulation
54	Legend of the Phoenix	1	0.4	Simulation
55	logical games	1	0.4	Logic
56	Machinarium	1	0.4	Adventure
57	Need for Speed	1	0.4	Sports
58	NHL	1	0.4	Sports
59	Ninja World	1	0.4	Action-adventure
60	Plants vs Zombies	1	0.4	Strategy
61	Red ball	1	0.4	Puzzle
62	Rust	1	0.4	Action
63	SAMP Arizona RP	1	0.4	Role-playing
64	Sherlock Holmes versus Jack the Ripper	1	0.4	Adventure
65	Snake	1	0.4	Casual
66	Sonic the Hedgehog	1	0.4	Action-adventure
67	SortPuz: Water Sort Puzzle	1	0.4	Puzzle
68	Soul Knight	1	0.4	Action
69	Sport games	1	0.4	Sports
70	StarCraft	1	0.4	Strategy
71	Stickman Party	1	0.4	Party
72	Suspects	1	0.4	Strategy
73	Temple Run	1	0.4	Endless runner
74	The Phantom of the Opera	1	0.4	Adventure
75	Tiles Hop: EDM Rush!	1	0.4	Action
76	Tomb of the Mask	1	0.4	Endless runner
77	Twelve Minutes	1	0.4	Puzzle
78	Warcraft	1	0.4	Role-playing
79	Warface	1	0.4	MMO

80	Webbed	1	0.4	Action-adventure
81	Wood Block Puzzle - Block Game	1	0.4	Puzzle
82	Words	1	0.4	Puzzle
83	World of Warcraft	1	0.4	Role-playing