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Students' Experience during the Integration of Traditional Games into the Elementary School Program

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Abstract

Even though the potential of game-based learning is widely recognized, we need to understand students to effectively integrate games in the classroom environment. This study aims to identify relevant factors that influence students' experience during the integration of traditional children's games into the elementary school program. The research involved 142 students from different elementary schools who participated in multiple learning sessions with pure game-based activities or games technologically enhanced with asynchronous/synchronous distance learning. A structural equation model was developed and tested using students' responses to a survey conducted after each session. The results suggest that students' experience is directly influenced by their motivation to participate in the new environment, their attitude during purely game-based classes, and technological behaviour during classes with distance learning activities. We also found that students of different ages showed similar subjective experience and identified a clear distinction between students' views and learning outcomes during in-class gaming and asynchronous/synchronous conditions.

Key words: *classroom games; elementary school; game-based learning; structural equation model; students' experience.*

Introduction

Since before the beginning of recorded history, children and adults have been playing games for fun and entertainment. Furthermore, games were also recognized

as a potential educational tool (Malone, 1981; Prensky, 2001; Wu, Hsiao, Wu, Lin, & Huang, 2012) that provides hands-on activities with authentic exercises and tasks, which increase students' achievements (Anzai & Simon, 1979; DuFour, DuFour, Eaker, & Many, 2006; Kirsh, 2009). Digital games have incorporated technology for better graphical representation and increased the popularity of game playing among the young population, while creating a necessity to incorporate solution-oriented and motivating attitudes of the player in the educational process (Reese, Tabachnick, & Kosko, 2015; Ritzhaupt, Poling, Frey, & Johnson, 2014). Even though the potential of game-based learning (GBL) is widely recognized, it is rather challenging to create or integrate existing games in the learning process (especially in state educational program) since theoretical principles may lack guidelines for practical implementation (Bellotti, Kapralos, Lee, Moreno-Ger, & Berta, 2013; Rice, 2007). Bearing in mind the fact that designers of commercial computer games generally focus on a powerful gaming experience rather than high-quality learning experience, several studies have researched the use of available computer games that have educational potential (Boyle, Hainey, Connolly, Gray, Earp, Ott, Lim, Ninaus, Ribeiro, & Pereira, 2016; Fong, 2006; Hitosugi, Schmidt, & Hayashi, 2014). An opposite approach is the design and creation of computer games especially intended for education (Burgos, Tattersall, & Koper, 2007; Kafai, 2006; Moreno-Ger, Burgos, Martínez-Ortiz, Sierra, & Fernández-Manjón, 2008), with educational content that can be shared and globalized to cover the cost charges of their development.

On the other hand, the latest advances in information and communication technology (ICT) are widely recognized as valuable learning tools that can significantly improve the learning process (Brun & Hinostroza, 2014; Leask & Pachler, 2013). Asynchronous distance learning solutions support work relations between the student and the teacher, separated in time and space (Andrade, Huang, & Bohn, 2013; Robert & Dennis, 2005; Sung & Hwang, 2013), while synchronous distance learning solutions provide interactive real-time environments and simulate social presence that resembles face-to-face interaction (Kuo, Walker, Belland, Schroder, & Kuo, 2014; Stewart, Harlow, & DeBacco, 2011; Tsuei, 2012). When combined with distance learning activities, GBL can create a communication bridge between students from different regions. At the same time, it stimulates positive social development patterns, reflected in direct interaction between those students and their peers. However, to be beneficial these technological possibilities and game integration in the classroom environment have to be carefully aligned.

This study presents research activities that are part of the project currently carried out in elementary schools in Macedonia, entitled "Grandma's games". The project promotes the incorporation of old, forgotten, traditional children's games in the everyday learning environment, fosters collaboration between students, and promotes constructivist learning through motivating classroom activities. The novelty of our approach lies in the integration of specific, technology-free games that children,

their parents or grandparents played, into the every-day learning process enhanced with different ICT solutions. The project was launched in 2010, following an experimental learning methodology that included several children's games aligned with the state learning curriculum. So far it has encompassed 10 different elementary schools, 15 teachers, and approximately 350 students. The games were introduced in the traditional classroom environment using limited technological tools such as presentation software, simple design applications, word and spreadsheet programs, but also enhanced with asynchronous/synchronous distance learning activities for increased collaboration and information processing.

The main purpose of this study is to identify relevant factors that influence students' quality needs and expectations while chosen traditional games are integrated into the elementary school program. Hence, the study identifies important factors such as motivation, ease of use, students' attitudes, technical performance of the utilized ICT, etc. that influence students' subjective expectations, as Quality of Experience (QoE), and tries to unify them in different learning conditions. Based on our hypothesis about connections between influencing factors and students' QoE, we developed a research model which was further tested during in-class gaming and online asynchronous/synchronous learning conditions during one school year.

Theoretical Framework

Play has an important role in children's cognitive development (Bodrova & Leong, 2003; Piaget, 1962; Vygotsky, 1978). It highly contributes to the development of language skills, imagination and visualization of goals, problem-solving attitude and socialization during group play. Even though Piaget's work (1962) on children's cognitive development does not directly relate to education, his idea that children learn best through discovering, active exploring, and doing is widely recognized in teaching practice. Vygotsky (1978) shares Piaget's assumptions about the ways children learn and focuses on the social context of learning, which he views through the lens of social constructivist theory. He highlights the fact that culture provides children with cognitive tools needed for development, in the form of cultural history, social context, and language, and identifies collaborative learning, games, and simulations as examples of social constructivist classroom activities. Similarly, the integration of traditional games in the classroom environment can provide cultural cognitive tools that can increase students' experience and improve the learning process.

On the other hand, while there is increasing research documenting the progress and outcomes of GBL, relatively little attention has been paid to students' perceptions and experience (Beavis, Muspratt, & Thompson, 2015). These demand additional scholarly efforts since students' experience can have practical implications with potential influence on learning. The QoE measurement, popularized by research focused on the social element and end users' expectations (Gong, Yang, Huang, & Su, 2009; Pierucci, 2015; Yuan, Ghinea, & Muntean, 2015; Zhang, Xu, & Cheng, 2011),

can be used in this context. Inferring students' QoE from individual (subjective) and technical (objective) factors, Vasileva-Stojanovska, Vasileva, Malinovski, and Trajkovik (2015) developed a QoE prediction model for a student-centred blended learning environment, equipped with an appropriate, technologically-enriched classroom. Malinovski, Vasileva, Vasileva-Stojanovska, and Trajkovik (2014) defined a prediction model that identifies relevant factors influencing high-school students' QoE in asynchronous and synchronous distance learning environments. However, despite some additional efforts to define a QoE model (Kilkki, 2008; Perkis, Munkeby, & Hillestad, 2006; Ward, Peters, & Shelley, 2010), there are inconsistencies regarding factors that should be taken into consideration for adequate QoE prediction.

Bearing in mind that this study explores old traditional games enhanced with modern computer technology, some of the variables in the technology acceptance model (TAM) can be merged in a students' QoE model. Such a model specifies a causal relationship between perceived usefulness and ease of use, attitude and actual usage behaviour, and addresses user acceptance of different technological solutions (Davis, 1993; Lee, Cheung, & Chen, 2005; Liu, Chen, Sun, Wible, & Kuo, 2010). Different studies have already used the TAM model to explain users' acceptance and ease of use of games for learning (Liang & Yeh, 2011; Pando-Garcia, Periañez-Cañadillas, & Charterina, 2016; Yusoff, Crowder, & Gilbert, 2010). For instance, Bourgonjon, Valcke, Soetaert, and Schellens (2010) developed a path model to examine and predict students' acceptance of video games in the learning environment, and evaluate their perception of usefulness, ease of use, and personal experience.

In addition, students' motivation has been recognized as a leading factor that determines student's engagement with the educational process. Highlighting the importance of motivation during GBL, Malone (1981) developed a rudimentary theory of intrinsically motivating instruction. Building on Malone's (1981) theory of intrinsic motivation, Hainey, Westera, Connolly, Boyle, Baxter, Beeby, and Soflano (2013) evaluated students' motivation and attitudes toward playing games and using them in education. They also provided a clear illustration of the distinction between students' views in regular and distance education. Different studies which investigated the effects of computer games on motivation and learning (Erhel & Jamet, 2013; Hanus & Fox, 2015; Tüzün, Yılmaz-Soylu, Karakuş, İnal, & Kızılkaya, 2009) suggest that some care should be taken when including GBL in educational settings.

The present study highlights the importance of students' motivational aspects during GBL as well as the performance of underlying technical solutions, and combines them with select TAM variables (ease of use and attitude that influence behavioural intentions). It also defines factors that influence elementary students' subjective QoE during the integration of traditional games into the school curriculum. We have formulated constructs that are unified and can be used in a pure game-based learning environment or enhanced with distance education activities. The possibilities to predict positive outcomes in similar GBL environments can help educational

institutions that plan to include traditional games as a learning tool in their curriculum to anticipate students' QoE and possibly increase learning outcomes.

Methodology

Participants

The study included 142 students from five elementary schools in Macedonia (part of the "Grandma's games" project) that showed interest in integrating classroom games in the learning process. These schools are located in different cities and villages across the country, which allowed us to include students from both urban and rural environments. In order to evaluate QoE among children of varying ages, the researchers selected students from different grades, more precisely the 2nd/3rd grade (students aged 7–8 years) and 6th/7th grade (students aged 11–12 years). The GBL classes were taught by nine different teachers who had the capacity to change the standard teaching practice and consistently integrate traditional games in the learning environment.

Design

Even though there is an abundance of commercial games with educational activities for elementary school children, we have chosen to use old traditional children's games played in our region. The games were selected in accordance with the state learning curriculum for different subjects, and enhanced with technology and distance learning activities. We have conducted an analysis of the educational prospects of several traditional games, as well as the possible subjects and thematic units from the national elementary school curriculum which could benefit from these games. Hence, we have chosen to cover three different subjects and include two games on different thematic units for each subject, equally distributed among the participating elementary schools during the 2013/2014 school year. Table 1 lists the traditional games according to school subject, along with detailed instructions, targeted skills, and learning objectives.

Table 1

Adopted traditional games for each subject, instructions and targeted skills

Game	Instructions	Subject	Skills
Hop-scotch	A geometric shape drawn on a floor is divided into eight fields with a specific design. Each field is marked with a number from one to eight. Each player tries to throw a stone inside each field in ascending order; if s/he is successful, s/he has to jump on one foot across all fields to the current one. The player then has to add the number in the field (or perform a different arithmetic operation) to his score. The player is not allowed to step on a line; similarly, the stone should not fall on a line. If the player fails, s/he has to wait for her/his turn, while other players try to cover all the fields.	Math	arithmetic operations, calculations, and understanding of different geometric forms

Game	Instructions	Subject	Skills
Match-box	Numbers are written on each side of an empty match-box. The box is placed on the edge of a table, while each player hits the outer half of the matchbox with his/her thumb. The matchbox flies up into the air; after it lands on the table, the player has to add the number on the upper side (or perform a different arithmetic operation) to his score. If s/he miscalculates, the others subtract the number (or perform a different operation) from her/his score. The game is played in a fixed number of rounds (usually five) and the highest score wins.	Math	arithmetic operations and calculations
Lady	Two players take turns ordering pebbles on a predefined schema to create checkers ("lady"). The schemes are designed with various materials, such as paper, dough, and clay. Each player has nine pebbles which s/he tries to sort in horizontal or vertical lines of three, according to the scheme.	Art	familiarization with materials, creating folklore-inspired scheme patterns
String	Players use a hemp string approximately 60 cm long and tied into knots at the ends to create different shapes by twisting and turning it around their fingers. The shapes are presented to the teacher and other players.	Art	understanding symmetry, parallel lines and dimensions
Hide and seek	One player is placed in the centre of a circle formed by the rest of the players holding hands. The player in the centre has a cloth tied over his/her eyes, while the rest of the players, preferably wearing folklore clothing, sing and dance around him. Once the players stop moving, the player in the centre moves towards a random player from the circle and tries to guess his/her name by using his/her senses of touch and smell, as well as his/her folklore clothing piece.	Nature and Society	recognizing individual similarities and differences, developing mental skills
Mosque	Five flat stones are placed one over the other to form a tower. The participants are divided in two teams. The first team tries to tear down the stack with a ball from a 2- to 3-meter distance. If the first team succeeds, the second team has to rebuild the stack. The members of the first team try to prevent the second team from rebuilding the stack by hitting them with the ball. Once a player is hit, s/he has to leave the game. The team that manages to rebuild the stack in the scheduled time wins the game.	Nature and Society	handling different emotions such as empathy, friendship, trust, as well as anger, conflict, discomfort, etc.

To reduce the influence of students' preferences towards certain subjects, the research included a variety of subjects. Hence, the results can demonstrate a higher statistical significance of students' perceived experience of gameplay in multiple conditions.

Additionally, motivated by the need to understand students' beliefs during the integration of classroom games into the elementary school program, and the wish to explore possibilities of combining distance education with GBL, we conducted research on three different teaching approaches:

- Classes organized around purely game-based activities, wherein each class included one of the six chosen traditional games enhanced with simple technological tools such as presentation software, design applications, word and spreadsheet programs;

- Asynchronous-based learning, wherein teachers provided recorded online materials in advance, as well as instructions and learning sessions used in classes they had previously taught (for each of the six chosen games). Thus, the students were able to prepare in advance and learn at home by organizing their own learning activities (home activities of younger learners were organized with parents' assistance) and corresponding with teacher when necessary. The actual class included a brief viewing of the streaming material and content repetition;
- Classes with a videoconferencing session organized among two elementary schools in different regions. Game-based activities were conducted as collaborative sessions wherein students motivated to "learn by doing" collaborate with children from the other school (under appropriate teacher supervision).

Classes organized exclusively around game-based activities allowed us to observe what happens when traditional games are included in a face-to-face environment. Since most of the implemented games were documented and recorded, the asynchronous way of learning provided the possibility for increased information processing while children were watching the GBL video at home. Synchronous learning via videoconferencing sessions provided an opportunity to connect two elementary schools and allow them to combine their individual resources (intellectual and material) in a joint learning session.

To sum up, we organized eighteen learning sessions during the school year. Each individual session on a specific subject had the same content with a different topic and slight variation on the game, so the results could be compared and abstracted from the actual material. For example, the following topics were covered in the Math lessons: number addition (game-based class for the 2nd/3rd grade), number subtraction (asynchronous enhancement) and both addition and subtraction (videoconferencing session). Students' performance was measured after each session, which enabled us to co-vary students' QoE results and learning outcomes.

Statistical Methods

Even though students' QoE is vitally important to the educational process, it is difficult to find proper ways to predict, quantify, and measure students' beliefs and expectations. Confirmatory factor analysis (CFA) is a statistical technique (Jöreskog & Sörbom, 1984) that defines a larger set of observed variables, which can be evaluated and measured while forming more complex unobserved variables (such as subjective QoE), referred to as latent constructs. In like manner, McIver and Carmines (1981) and Nunnally and Bernstein (1994) explain why multi-item measures are more adequate than single-items for measuring complex constructs. Methodologically, structural equation modelling (SEM) can help researches answer different questions (Bollen, 1998), while creating a model that represents the causal relationship among different latent constructs, such as factors which influence students' experience during integration of games in elementary school programs. We have chosen SEM, since the high confidence level in SEM models ensures factors missing from the analysis are sufficiently covered with the chosen latent

constructs. In addition, we have used the Kruskal-Wallis test (Kruskal & Wallis, 1952), a non-parametric equivalent of one-way analysis of variance, to perform statistical comparison and precisely locate the difference in students' performance between the teaching approaches. Consequently, the QoE model results and evaluation of students' performance can provide comparison between students' experience and learning outcomes in different conditions.

Instrument

Since the main purpose of the study was to develop a model that adequately represents factors influencing students' QoE during the integration of traditional games in the elementary school curriculum, a questionnaire was developed to gather students' opinions as multi-item measures on chosen constructs after each learning session. The questionnaire was based on our experience during the "Grandma's games" project and the previously presented theoretical framework. The instrument is described below, with the necessary difference for different learning conditions.

Technical Behaviour

The classes that included distance-learning activities utilized certain technical solution, which the students can experience differently. Even though today's children are considered to be sophisticated and knowledgeable ICT consumers (Prensky, 2001; SElwyn & Bullon, 2000) and are eager to play games (Bourgonjon et al., 2010; Prensky, 2001), when the games are used in the class and enhanced with different technological solutions, the results may not always be positive. Therefore, the first section in the questionnaire contained standard items related to technical performance in distance-learning solutions as in Vasileva-Stojanovska et al. (2015), including questions on the quality of audio/video signal and their mutual synchronization. This part was excluded from the survey designed for purely game-based activities.

Ease of Use, Attitude, and Motivation

Consistent with prior studies (Bourgonjon et al., 2010; Lee, Cheung, & Chen, 2005; Liang & Yeh, 2011; Liu et al., 2010; Sung & Hwang, 2013; Ward, Peters, & Shelley, 2010; Yusoff, Crowder, & Gilbert, 2010), the relationships between latent constructs that reflect the ease of use and attitude towards new technologies, as well as motivation and satisfaction (Erhel & Jamet, 2013; Hainey et al., 2013; Tüzün et al., 2009), can demonstrate significant strengths. Therefore, the second section of the questionnaire contains items adopted from TAM studies (Bourgonjon et al., 2010; Liang & Yeh, 2011; Liu et al., 2010; Yusoff, Crowder, & Gilbert, 2010) to reflect on ease of use as students' beliefs regarding teacher-student interaction and comprehensibility of content, which indirectly links teacher's performance and game presentation as multilevel covariates. Similarly, the following section surveys items related to students' attitudes towards these new teaching approaches; the one after that uses an adapted motivational scale to evaluate students' motivation for playing games and using them in an educational environment (Erhel & Jamet, 2013; Hainey et al., 2013; Hanus & Fox, 2015; Malone, 1981; Tüzün et al., 2009).

Quality of Experience

The final section in the questionnaire adopts items from previous QoE studies (Malinovski et al., 2014; Vasileva-Stojanovska et al., 2015; Ward, Peters, & Shelley, 2010) to gather students' subjective experience and quality expectations regarding the inclusion of traditional games in the classroom environment. As such, it covers students' beliefs regarding increased efficiency and productivity in class, their enjoyment, and overall experience of this type of school activities.

Students' Age

Since age plays a significant role in children's psychological, emotional, and cognitive development (Prensky, 2001; Vygotsky, 1978), the integration of games in the elementary school learning curriculum can depend on the students' age. Therefore, student age was included in the analysis and later correlated to other constructs and items from the questionnaire.

Table 2 lists the questionnaire items: each question represents a research variable as one of the indicators of the chosen constructs, with a necessary difference for different learning conditions. Students were asked to grade each research question on a five-point Likert scale (Likert, 1931) after each learning session. The scale was represented with graphical illustrations – five smiley faces (a face with a wide smile indicates grade 5, while an extremely sad face illustrates grade 1). Children were asked to express their beliefs by circling an appropriate smiley face.

Table 2

Questionnaire items, referred latent constructs, and their indicators

Questionnaire item	Construct	Indicator
Rate the video signal quality	TECHNICAL	Tech1
Rate the audio signal quality		Tech2
Were the audio and video synchronized		Tech3
Did the equipment*/streaming media delivery** work properly		Tech4
Were you able to easily follow the lesson	EASY	Easy1
How was the interaction with the teacher*/instructional guidelines**		Easy2
Did you understand the context		Easy3
Did the game play feel natural during learning		Easy4
Did you like this teaching approach	ATTITUDE	Att1
Would you like to attend similar class in the future		Att2
Do you like novelties in teaching practice in general		Att3
Did the game play challenge you to finish the task	MOTIVATION	Motiv1
Would you motivate other children to attend similar classes		Motiv2
Will you use the same game at home during learning		Motiv3
Will you individually use other games for learning		Motiv4
Do you think the game helped you to better understand the lesson	QoE	QoE1
Did the game play introduced new and valuable possibilities		QoE2
Is this approach a more interesting and successful type of learning		QoE3
What was your overall experience of this type of school activity		QoE4

Note. Variations for different teaching approaches: * = synchronous or game-based only classes, ** = asynchronous learning sessions

Figure 1 illustrates the proposed QoE model, based on the presented theoretical framework, chosen TAM variables and relations, and the study's research instrument, which guided our further research. Since the variety in students' age can produce different results, the model includes a moderator age variable. Hence, SEM was used to analyse students' responses from the questionnaire after each learning session and determine statistically significant value weights for the relationships between constructs in the proposed QoE model, including measurements errors in the analysis.

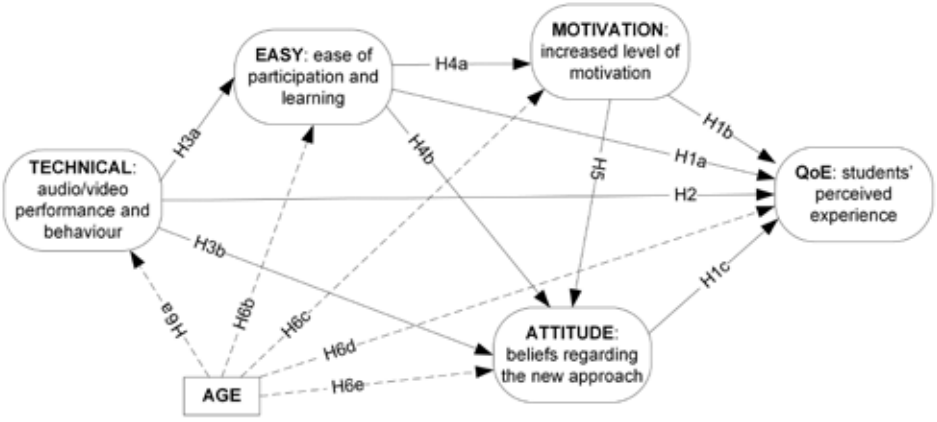

Figure 1. Research model illustrating students' perceptions during the integration of games in the elementary school program

Results

Descriptive Statistics

The 142 student participants attended two learning sessions on the chosen subjects, which followed the three teaching approaches. The classes were organized during the whole school year and all students could not participate in every learning session (due to absence from school); rather, approximately each student attended at least five of the six learning sessions for each teaching approach. The collected demographic information indicates that the student population consists of 53.5% male and 46.5% female students, 29.6% 12-year-olds, 28.4% 11-year-olds, 23.5% 8-year-olds, and 18.5% 7-year-olds, and encompasses students from both upper and lower grades. It was also found that 66% of these students live in smaller and bigger cities, while 34% live in different villages.

A total of 721 students' responses were gathered from the pure game-based classes, 713 responses from classes which included game-play enhanced with asynchronous activities, and 709 responses from classes organized with videoconferencing session. Before performing CFA, we examined the nature of students' responses after each teaching approach and compared individual variable measurements for mean score and standard deviation (Table 3).

Table 3

Descriptive statistical information for observed indicators during each teaching approach

Indicator	Classical GBL (n=721)		Asynchronous GBL (n=713)		Synchronous GBL (n=709)	
	Mean	SD	Mean	SD	Mean	SD
Easy1	4.88	0.459	4.75	0.614	4.75	0.765
Easy2	4.80	0.498	4.64	0.641	4.64	0.772
Easy3	4.80	0.519	4.64	0.686	4.68	0.737
Easy4	4.78	0.576	4.55	0.853	4.52	0.935
Att1	4.86	0.516	4.76	0.619	4.77	0.719
Att2	4.80	0.559	4.70	0.654	4.65	0.761
Att3	4.66	0.735	4.65	0.707	4.76	0.678
Motiv1	4.83	0.559	4.74	0.660	4.77	0.750
Motiv2	4.83	0.516	4.70	0.699	4.72	0.774
Motiv3	4.75	0.675	4.63	0.780	4.68	0.803
Motiv4	4.82	0.534	4.69	0.694	4.72	0.813
Tech1	-	-	4.61	0.679	4.30	1.076
Tech2	-	-	4.51	0.830	4.13	1.171
Tech3	-	-	4.58	0.729	4.18	1.141
Tech4	-	-	4.67	0.640	4.27	1.125
QoE1	4.83	0.564	4.77	0.601	4.75	0.721
QoE2	4.75	0.639	4.65	0.755	4.67	0.772
QoE3	4.83	0.518	4.75	0.635	4.74	0.743
QoE4	4.87	0.487	4.74	0.655	4.75	0.734

Note. SD = standard deviation

The descriptive results show that the learning sessions that incorporated only classroom games provided slightly higher level of positive students' experience on most of the research variables than classes enhanced with distance education activities, which demonstrated the lowest mean scores on the technical indicators. Nevertheless, further analysis was needed to illustrate the relationship between the latent constructs and their direct influence on students' QoE. The descriptive results have a satisfactory standard deviation, which shows that the students' responses were constructive in nature.

Table 4

Cronbach's alpha test results for latent constructs for each teaching approach

Construct	No. of items	Classical GBL Cronbach's alpha	Asynchronous GBL Cronbach's alpha	Synchronous GBL Cronbach's alpha
EASY	4	0.822	0.868	0.865
ATTITUDE	3	0.766	0.863	0.875
MOTIVATION	4	0.839	0.876	0.914
TECHNICAL	4	-	0.886	0.957
QoE	4	0.795	0.890	0.924

Note. The threshold for all Cronbach's alpha values is > 0.7

Consequently, we have continued with the initial analysis while using Cronbach's alpha (Cronbach, 1951) as a test reliability technique to examine internal consistency of the observed variables, intended to measure the underlying construct. This has

produced relevant alpha-test results (Table 4). Estimates of the Cronbach's alpha value can range from 0 to 1, which generally increases when correlations between the items increase. Since alpha values for constructs higher than 0.7 represent good internal consistency of items in the scale (Nunnally & Bernstein, 1994), the results show that we can use this data for further factor analysis and model testing.

Measurement Model

Since social-studies-based research activities on complex topics cannot include all possible factors, it is necessary to develop a measurement model, which relates measured variables (indicators) to latent variables (constructs) with included measurement errors. Therefore, the missing factors that influence the outcomes can be evaluated within the variables that are part of the researched model. Since assumptions of multivariate normality were met accordingly, we used the collected data set from the students' responses to develop a measurement model and examine factor loadings between the latent variables and proposed observed indicators, bearing in mind that standardized factor loading estimates should be 0.50 or higher – ideally 0.70 or higher (Nunnally & Bernstein, 1994). Furthermore, the variables' reliability and convergent validity was examined via the average variance extracted (AVE) and construct reliability (CR). A good rule of thumb suggests that CR should be at least 0.70 (values between 0.60 and 0.70 may be acceptable if other indicators of a model's construct validity are good), while AVE should be at least 0.50, since lower values indicate that there is more error remaining in the items than the variance explained by the latent structure. The measurement model has produced results with factor loading on all indicators above the ideal value 0.70; exceptions include Att3 and QoE2 during game-based only learning sessions, and Easy4 during classes with videoconferencing (still with values > 0.50). The obtained CR and AVE values are illustrated in Table 5.

Table 5

Reliability results for latent variables in the measurement model for each teaching approach

Construct	Classical GBL		Asynchronous GBL		Synchronous GBL	
	CR	AVE	CR	AVE	CR	AVE
EASY	0.72	0.54	0.83	0.63	0.83	0.64
ATTITUDE	0.73	0.55	0.86	0.68	0.89	0.70
MOTIVATION	0.75	0.57	0.83	0.64	0.90	0.72
TECHNICAL	-	-	0.85	0.66	0.92	0.75
QoE	0.67	0.50	0.86	0.67	0.97	0.84

Note. CR and AVE values are above the desired thresholds

The results show that all CR values are higher than 0.70, except for the QoE construct during game-based only learning sessions, which is still acceptable, while all AVE values are above the desired 0.50. Hence, the measurement model for each teaching approach has provided relevant standardized factor loading estimates between the latent variables and proposed observed indicators, with adequate reliability and convergent validity.

While observing the standardized residual covariances and modification indices we have noticed that some indicators (Motiv4 in game-based learning sessions; Easy4 and Tech4 in classes with asynchronous activities; and Easy4 in classes with videoconferencing) and their respective error measurements have high covariance values in their respective models (Hair, Anderson, Tatham, & Black, 1998). Thus, we have considered the removal of these indicators to provide a better model fit in the next steps of the analyses.

Structural Model

We have developed a structural model to determine if the proposed research model, which illustrates the factors influencing students' experience during the integration of games in elementary school programs (Figure 1), is valid and fits the research data in any situation. Since structural equation models do not have single statistical tests that can display the validity of the results, each model has to satisfy multiple fit indices, which at least include the following: relative chi-square (CMIN/df), in which values as low as 2 or as high as 5 indicate a reasonable fit (Marsh & Hocevar, 1985); goodness of fit index (GFI); comparative fit index (CFI) and normed fit index (NFI), in which all values should exceed the 0.9 recommended minimum (Bentler & Bonett, 1980; Hu & Bentler, 1999; Jöreskog & Sörbom, 1984); and root mean square error of approximation (RMSEA), in which smaller values below 0.08 are preferable (Browne & Cudeck, 1993).

Bearing in mind that the measurement analysis has revealed which indicators (Motiv4 in pure game-based learning sessions, Easy4 and Tech4 in classes enhanced with asynchronous activities, and Easy4 in synchronous distance education activities) can be removed for model refinement, we have tested the necessary model fit indices with and without these indicators (Table 6).

Table 6

Goodness of fit indices for the initial and revised structural model

Indicator	Classical GBL		Asynchronous GBL		Synchronous GBL	
	Initial	Revised	Initial	Revised	Initial	Revised
CMIN	589.624	402.247	853.181	585.365	866.166	656.120
df	95	81	157	122	157	139
CMIN/df	6.207	4.966	5.434	4.798	5.517	4.720
GFI	0.908	0.930	0.895	0.918	0.892	0.911
CFI	0.920	0.940	0.934	0.950	0.948	0.960
NFI	0.906	0.927	0.920	0.938	0.937	0.950
RMSEA	0.085	0.074	0.079	0.073	0.080	0.072

Note. Revised model values indicate a good fit

The results show that goodness-fit indices were improved through the model refinement process, while providing values that satisfy the suggested guidelines. Therefore, we have made the necessary changes and revised the structural equation model illustrating complex relationships among the researched constructs during pure game-based learning sessions (Figure 2).

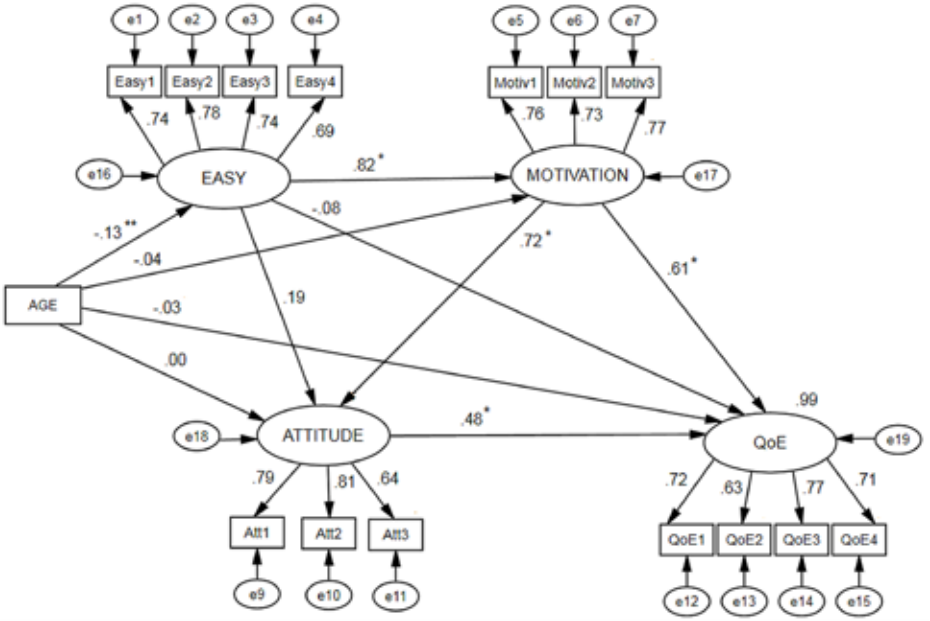

Figure 2. Structural equation model with factors influencing students' experience during the integration of pure classroom games in elementary schools (*p<0.001 and **p<0.01 report significant paths, two-tailed)

The presented results show that students' QoE in learning sessions that include traditional games can be strongly predicted with R2 of 0.99 and are mostly determined by the latent variables MOTIVATION (β=0.61, p<0.001) and ATTITUDE (β=0.48, p<0.001). The results of the analysis also show a strong direct connection between EASY/MOTIVATION (β=0.82, p<0.001) and MOTIVATION/ATTITUDE (β=0.72, p<0.001). However, we did not find a direct and statistically significant relationship between EASY/QoE and EASY/ATTITUDE, which reported p>0.05. The difference in students' age did not play an important role in this model since only AGE and EASY (β=0.61, p=0.001) correlate with each other, while the rest of the paths (AGE/ATTITUDE, AGE/MOTIVATION, AGE/QoE), all with p>0.05, have no significant influence.

In line with the discovery made in the measurement analysis, we have also revised the structural equation model which represents significant structural relationships among latent variables during GBL classes that included asynchronous/synchronous distance learning activities (Figure 3).

SEM results for combining distance learning activities with GBL identify similar behaviour for asynchronous and synchronous enhancements, while accounting for R2 of 0.92 for the QoE construct. The findings show that this construct is significantly determined by the following latent variables: MOTIVATION (β=0.61/0.53 for async./sync., p<0.001) and TECHNICAL (β=0.09/0.10 for async./sync., p<0.001).

EASY demonstrates different behaviour which directly influenced QoE during videoconferencing sessions and game-play activities (β=0.20, p<0.001). The same path did not report statistical significance during asynchronous activities (p>0.05). This sounds logical, since elementary school students depend on teacher-student interaction and ease of participation during videoconferencing sessions, which can be neglected during asynchronous learning. The paths between AGE/QoE and ATTITUDE/QoE reported p>0.05, which shows no significant influence in the analysis of the QoE of these particular students.

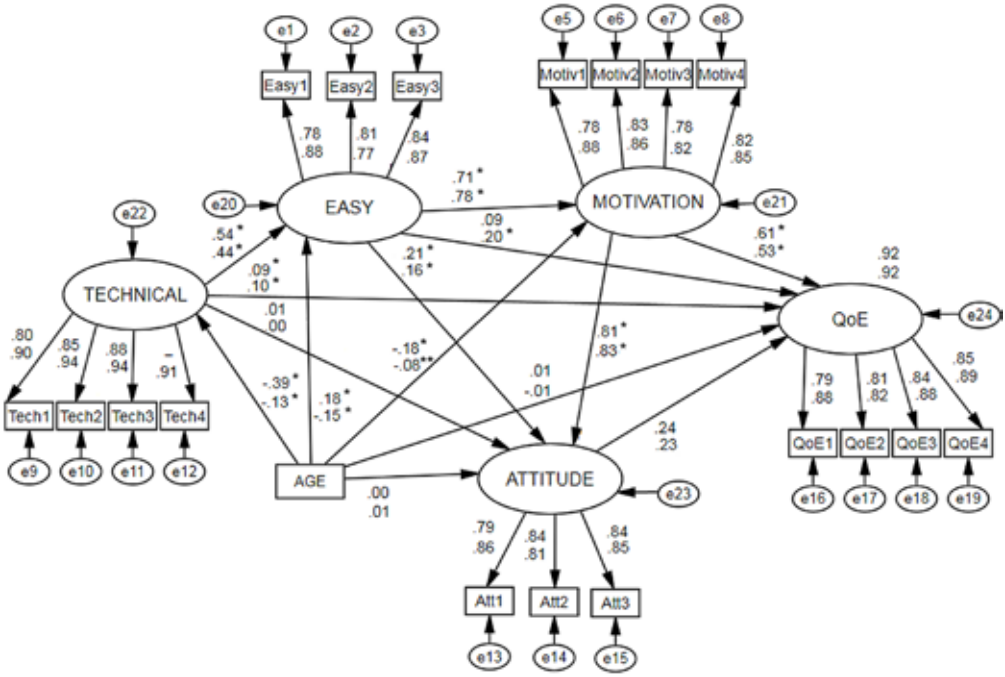

Figure 3. Structural equation model during the integration of classroom games enhanced with distance learning activities in elementary schools (upper values results represent asynchronous; lower synchronous where *p<0.001 and **p<0.01 report significant paths, two-tailed)

Additionally, the results show direct effect between MOTIVATION/ATTITUDE (β=0.81/0.83 for async./sync., p<0.001), EASY/MOTIVATION (β=0.71/0.78 for async./sync., p<0.001), EASY/ATTITUDE (β=0.21/0.16 for async./sync., p<0.001), and TECHNICAL/EASY (β=0.54/0.44 for async./sync., p<0.001). The students' age proved important for paths between AGE/TECHNICAL (β=-0.39/-0.13 for async./sync., p<0.001), AGE/EASY (β=0.18/-0.15 for async./sync., p<0.001) and AGE/MOTIVATION (β=-0.18 for async., p<0.001 and β=-0.08 for sync., p=0.005). Students' attitudes were not directly influenced by the technical setup or their age, since TECHNICAL/ATTITUDE and AGE/ATTITUDE reported p>0.05.

QoE and Learning Outcomes

The teachers graded students after each learning session from 1 (poor) to 5 (excellent) on their interest, interactivity, and test performance. With these results, we were able to test the statistical differences in learning outcomes during sessions with pure game-based activities or games technologically enhanced with asynchronous/synchronous distance learning. Based on this, we have defined three performance-dependant variables: interest, interactivity, and test score, with teaching approach as a grouping variable. We have performed the Kruskal-Wallis test for these variables to precisely locate the difference in students' performance between teaching approaches. The descriptive statistics for students' learning outcomes are summarized in Table 7, while Table 8 lists the Kruskal-Wallis test results for each pair of teaching approaches, performed at a confidence level of 95%.

Table 7

Descriptive statistical information for students' performance

Indicator	Classical GBL (n=721)		Asynchronous GBL (n=713)		Synchronous GBL (n=709)	
	Mean	SD	Mean	SD	Mean	SD
Interest	4.52	0.813	4.34	0.905	4.27	1.036
Interactivity	4.54	0.755	4.37	0.870	4.36	0.939
Test score	4.57	0.751	4.44	0.816	4.40	0.917

Note. SD = standard deviation

Table 8

Kruskal-Wallis test for interest, interactivity, and test score for three pairs of teaching approaches

Teaching approach		Interest	Interactivity	Test score
Classical GBL / Asynchronous GBL	Chi-Square	18.624	15.243	13.246
	p-value	0.00002*	0.00010*	0.00027*
Classical GBL / Synchronous GBL	Chi-Square	17.977	10.299	12.937
	p-value	0.00002*	0.00133*	0.00032*
Asynchronous / Synchronous GBL	Chi-Square	0.019	0.310	0.010
	p-value	0.88931	0.57769	0.92049

Note. p-value = probability, where *p<0.05 reports statistical significance

The findings suggest that the difference in students' performance is statistically significant during classes with games-based activities and classes with asynchronous or synchronous enhancements ($p<0.05$). The results did not show a significant statistical difference ($p>0.05$) in students' performance between classes with asynchronous and synchronous distance learning activities. Consequently, these findings follow the clear distinction between students' QoE during in-class gaming and distance learning conditions, which co-varies the variables in SEM and students' subjective experience with the learning outcomes.

Discussion

This study presents a unified QoE model during the integration of traditional games into the elementary school program. Its results suggest that the influencing factors can be divided into two categories:

- important factors (motivation and attitude related) during classes that engage students through GBL in a traditional environment;
- factors influencing classes that include traditional games enhanced with distance learning activities, based on students' motivation and technical setup in both asynchronous and synchronous environments, and ease of participation during videoconferencing-based learning sessions.

These findings correlate with those described by Hainey et al. (2013), which illustrate a clear distinction between students' views in regular education and those in distance education. Additionally, we were able to illustrate students' experience and quality expectation in in-class gaming and online asynchronous/synchronous learning conditions which incorporated traditional games. More precisely, students' beliefs regarding fun incorporated with learning (QoE3) regressed highly for QoE during in-class gaming conditions, while their overall satisfaction (QoE4) was the highest regression factor during asynchronous/synchronous conditions. Therefore, the implementation of traditional games in the classroom was primarily considered to be a fun and interesting activity in the traditional teaching approach, while students' overall satisfaction proved to be the most important indicator when the distance learning approach was introduced with the GBL.

The results strongly support the outcomes of existing studies (Erhel & Jamet, 2013; Hainey et al., 2013; Malinovski et al., 2014; Malone, 1981; Tüzün et al., 2009) which emphasize the importance of students' motivation during GBL, while explaining additional latent relationships that influence students' QoE. Putting aside the select teaching approach, motivational aspects were the strongest influencing factor on students' experience. For example, the Hop-scotch or Match-box traditional games included in Math classes motivated students to actively participate in arithmetic operations, which directly increased their QoE. The results also show that even though today's children are considered to be sophisticated and knowledgeable ICT consumers (Selwyn & Bullon, 2000; Prensky, 2001), technological performance during the interactive/streaming sessions also influenced students' experience, since at this age they are not able to intuitively compensate the variation in technical quality during distance learning activities. Therefore, when traditional games and GBL are combined with distance learning solutions a proper technical setup should be established in advance. On the other hand, the variance in students' age did not relate to their subjective QoE in any learning environment. Putting aside the size of the primary-school class into which the games were included, students' experiences appear similar and not influenced by their age. This is seen as an advantage since similar approaches may be applied to all grades.

This study also provides empirical evidence that ease of use influenced students' motivation and attitude during these novel teaching approaches. Hence, the importance of teacher-student interaction (which emphasizes the importance of teachers' competencies) and proper representation of content (Malinovski et al., 2014; Ward, Peters, & Shelley, 2010) via the chosen game are significant factors in similar learning environments, even though they do not directly correlate with students' experience, except in the synchronous environment. In addition, students' attitude towards each of the three teaching approaches was also influenced by students' motivation to participate, which altogether complicates but does not contradict similar technology acceptance models (Davis, 1993; Lee, Cheung, & Chen, 2005; Liu et al., 2010; Yusoff, Crowder, & Gilbert, 2010) focused on the use of technology.

Consequently, the findings in this study demonstrate that purely game-based learning environments produce a higher level of students' experience and learning outcomes compared to those enhanced with some form of distance education activities. Therefore, additional effort is needed to improve students' motivation to attend similar classes, and provide adequate technological set up and quality in cases when distance learning tools are preferable. Bearing in mind the fact that students' views and their subjective experience co-vary with their performance, a proper student-centred approach that increases the positive level of students' QoE is an important step ahead towards increased learning achievements.

Conclusion

Due to their educational potential, games can be used as an instructional add-on to different educational contexts or be fully incorporated into the educational environment. Since it is important to understand learners during GBL, this study follows a student-centred approach while analysing a wide area of factors that influence students' experience during the integration of traditional classroom games into the elementary school program. We have presented important variables that can adequately predict the level of positive students' QoE, while providing a model that illustrates the causal relationships between latent constructs in different learning conditions. The findings demonstrate that the selected factors account for more than 90% of the variance in students' QoE in any situation, reflected as students' satisfaction, fun incorporated with learning, and students' beliefs regarding increased efficiency and productivity.

In our research, we used children's traditional games in the classroom environment and encouraged elementary school students to survey family members on games played in their region and thus preserve their cultural heritage. Even though distance education is not widely spread in elementary school programs, we explored the possibility of adding certain distance education activities to enhance the GBL process. We therefore provided students with learning materials in advance, thus allowing them additional flexibility when it comes to organizing their learning

activities (asynchronous) or created a collaborative learning environment based on a videoconferencing session that was incorporated in game-based activities conducted by two distant schools, while comparing in-class gaming and online asynchronous/synchronous conditions. The research model was tested using responses to students' survey after each class, which resulted in an adequate SEM-based model fit. As we have illustrated, this model can predict actual elementary school students' behaviour and QoE. This study can help school administrators and practicing teachers with scientific evidence of factors predicting students' experience when educational games are used in classroom.

We also assessed students' performance regarding interest, interactivity, and grades in the three different conditions, which correlated to their QoE. Even though the comparison between the learning outcomes during different learning conditions was brief and informational, future analyses can use the proposed QoE model and validated measurements in evaluations of additional factors such as existing knowledge, students' cognitive capabilities, personal learning style, etc., to provide a detailed correlation between the QoE and learning outcomes in similar environments.

References

Andrade, J., Huang, W-H. D., & Bohn, D. M. (2013). The Impact of Instructional Multimedia and College Students' Epistemological Learning Beliefs on Mental Effort Investment in Asynchronous Learning. In M. Simonson (Ed.), *Proceedings of the 2013 Annual Convention of the AECT* (pp. 9-17). Anaheim, CA: Nova Southeastern University.

Anzai, Y., & Simon, H. A. (1979). The Theory of Learning by Doing. *Psychological Review*, *86*(2), 124–140. https://doi.org/10.1037/0033-295X.86.2.124

Beavis, C., Muspratt, S., & Thompson, R. (2015). 'Computer Games Can Get Your Brain Working': Student Experience and Perceptions of Digital Games in the Classroom. *Learning, Media and Technology*, *40*(1), 21–42. https://doi.org/10.1080/17439884.2014.904339

Bentler, P. M., & Bonett, D. G. (1980). Significance Tests and Goodness-of-Fit in Analysis of Covariance Structures. *Psychological Bulletin*, *88*(3), 588–606. https://doi.org/10.1037/0033-2909.88.3.588

Bellotti, F., Kapralos, B., Lee, K., Moreno-Ger, P., & Berta, R. (2013). Assessment in and of Serious Games: An Overview. *Advances in Human-Computer Interaction*, *2013*, 1–11. https://doi.org/10.1155/2013/136864

Bodrova, E., & Leong, D. J. (2003). The Importance of Being Playful. *Educational Leadership*, *60*(7), 50–53.

Bollen, K. A. (1998). *Structural Equation Models*. New York: John Wiley & Sons, Ltd.

Bourgonjon, J., Valcke, M., Soetaert, R., & Schellens, T. (2010). Students' Perceptions about the Use of Video Games in the Classroom. *Computers & Education*, *54*(4), 1145–1156. https://doi.org/10.1016/j.compedu.2009.10.022

Boyle, E. A., Hainey, T., Connolly, T. M., Gray, G., Earp, J., Ott, M., Lim, T., Ninaus, M., Ribeiro, C., & Pereira, J. (2016). An Update to the Systematic Literature Review of Empirical Evidence of the Impacts and Outcomes of Computer Games and Serious Games. *Computers & Education*, *94*, 178–192. https://doi.org/10.1016/j.compedu.2015.11.003

Browne, M.W., & Cudeck, R. (1993). Alternative Ways of Assessing Model Fit. In Bollen, K.A., & Long, J. S. (Eds.), *Testing Structural Equation Models* (pp. 136–162). SAGE Publications: London.

Brun, M., & Hinostroza, J. E. (2014). Learning to Become a Teacher in the 21st Century: ICT Integration in Initial Teacher Education in Chile. *Journal of Educational Technology & Society*, *17*(3), 222–238.

Burgos, D., Tattersall, C., & Koper, R. (2007). Re-Purposing Existing Generic Games and Simulations for E-Learning. *Computers in Human Behavior*, *23*(6), 2656–2667. https://doi.org/10.1016/j.chb.2006.08.002

Cronbach, L. J. (1951). Coefficient Alpha and the Internal Structure of Tests. *Psychometrika*, *16*(3), 297–334. https://doi.org/10.1007/BF02310555

Davis, F. D. (1993). User Acceptance of Information Technology: System Characteristics, User Perceptions and Behavioral Impacts. *International Journal of Man-Machine Studies 38*(3), 475–487. https://doi.org/10.1006/imms.1993.1022

DuFour, R., DuFour, R., Eaker, R., & Many, T. (2006). *Learning by Doing*. Bloomington, IN: Solution Tree.

Erhel, S., & Jamet, E. (2013). Digital Game-Based Learning: Impact of Instructions and Feedback on Motivation and Learning Effectiveness. *Computers & Education*, *67*, 156–167. https://doi.org/10.1016/j.compedu.2013.02.019

Fong, G. (2006). Adapting COTS Games for Military Experimentation. *Simulation & Gaming*, *37*(4), 452–465. https://doi.org/10.1177/1046878106291670

Gong, Y., Yang, F., Huang, L., & Su, S. (2009) Model-Based Approach to Measuring Quality of Experience. In *Proceedings of the 2009 First International Conference on Emerging Network Intelligence* (pp. 29–32). IEEE. https://doi.org/10.1109/EMERGING.2009.17

Hainey, T., Westera, W., Connolly, T. M., Boyle, L., Baxter, G., Beeby, R. B., & Soflano, M. (2013). Students' Attitudes toward Playing Games and Using Games in Education: Comparing Scotland and the Netherlands. *Computers & Education*, *69*, 474–484. https://doi.org/10.1016/j.compedu.2013.07.023

Hair, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (1998). *Multivariate Data Analysis* (5th edition). New York: Prentice Hall International.

Hanus, M. D., & Fox, J. (2015). Assessing the Effects of Gamification in the Classroom: A Longitudinal Study on Intrinsic Motivation, Social Comparison, Satisfaction, Effort, and Academic Performance. *Computers & Education*, *80*, 152–161. https://doi.org/10.1016/j.compedu.2014.08.019

Hitosugi, C. I., Schmidt, M., & Hayashi, K. (2014). Digital Game-Based Learning (DGBL) in the L2 Classroom: The Impact of the UN's Off-the-Shelf Videogame, *Food Force*, on Learner Affect and Vocabulary Retention. *CALICO Journal*, *31*(1), 19–39. https://doi.org/10.11139/cj.31.1.19-39

Hu, L. T., & Bentler, P.M. (1999). Cutoff Criteria for Fit Indexes in Covariance Structure Analysis: Conventional Criteria Versus New Alternatives. *Structural Equation Modelling:*

A Multidisciplinary Journal, *6*(1), 1–55. https://doi.org/10.1080/10705519909540118

Jöreskog, K. G., & Sörbom, D. (1984). *LISREL-VI User's Guide*. Mooresville, IN: Scientific Software.

Kafai, Y. B. (2006). Playing and Making Games for Learning. Instructionist and Constructionist Perspectives for Game Studies. *Games and Culture*, *1*(1), 36–40. https://doi.org/10.1177/1555412005281767

Kilkki, K. (2008). Quality of Experience in Communications Ecosystem. *Journal of Universal Computer Science*, *14*(5), 615–624.

Kirsh, D. (2009). Problem Solving and Situated Cognition. In P. Robbins, & M. Aydede (Eds.), *The Cambridge Handbook of Situated Cognition* (pp. 264–306). Cambridge: Cambridge University Press.

Kruskal, W. H., & Wallis, W. A. (1952). Use of Ranks in One-Criterion Variance Analysis. *Journal of the American Statistical Association*, *47*(260), 583–621. https://doi.org/10.1080/01621459.1952.10483441

Kuo, Y. C., Walker, A. E., Belland, B. R., Schroder, K. E., & Kuo, Y. T. (2014). A Case Study of Integrating Interwise: Interaction, Internet Self-Efficacy, and Satisfaction in Synchronous Online Learning Environments. *The International Review of Research in Open and Distributed Learning*, *15*(1), 161–181. https://doi.org/10.19173/irrodl.v15i1.1664

Leask, M., & Pachler, N. (Eds.) (2013). *Learning to Teach Using ICT in the Secondary School: A Companion to School Experience*. London: Routledge.

Lee, M. K., Cheung, C. M., & Chen, Z. (2005). Acceptance of Internet-Based Learning Medium: The Role of Extrinsic and Intrinsic Motivation. *Information & Management*, *42*(8), 1095–1104. https://doi.org/10.1016/j.im.2003.10.007

Liang, T. P., & Yeh, Y. H. (2011). Effect of Use Contexts on the Continuous Use of Mobile Services: The case of Mobile Games. *Personal and Ubiquitous Computing, 15*(2), 187–196. https://doi.org/10.1007/s00779-010-0300-1

Likert, R. (1931). A Technique for the Measurement of Attitudes. *Archives of Psychology*, *140,* 44–53.

Liu, I. F., Chen, M. C., Sun, Y. S., Wible, D., & Kuo, C. H. (2010). Extending the TAM Model to Explore the Factors That Affect Intention to Use an Online Learning Community. *Computers & Education*, *54*(2), 600–610. https://doi.org/10.1016/j.compedu.2009.09.009

Malinovski, T., Vasileva, M., Vasileva-Stojanovska, T., & Trajkovik, V. (2014). Considering High School Students' Experience in Asynchronous and Synchronous Distance Learning Environments: QoE Prediction Model. *The International Review of Research in Open and Distributed Learning*, *15*(4), 91–112. https://doi.org/10.19173/irrodl.v15i4.1808

Malone, T. W. (1981). Toward a Theory of Intrinsically Motivating Instruction. *Cognitive Science*, *5*(4), 333–369. https://doi.org/10.1207/s15516709cog0504_2

Marsh, H. W., & Hocevar, D. (1985). Application of Confirmatory Factor Analysis to the Study of Self-Concept: First- and Higher-Order Factor Models and Their Invariance across Groups. *Psychological Bulletin*, *97*(3), 562–582. https://doi.org/10.1037/0033-2909.97.3.562

McIver, J. P., & Carmines, E. G. (1981). *Unidimensional Scaling*. Thousand Oaks, CA: Sage. https://doi.org/10.4135/9781412986441

Moreno-Ger, P., Burgos, D., Martínez-Ortiz, I., Sierra, J. L., & Fernández-Manjón, B. (2008). Educational Game Design for Online Education. *Computers in Human Behavior*, *24*(6), 2530–2540. https://doi.org/10.1016/j.chb.2008.03.012

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric Theory* (3rd ed). New York: McGraw-Hill.

Pando-Garcia, J., Periañez-Cañadillas, I., & Charterina, J. (2016). Business simulation games with and without supervision: An analysis based on the TAM model. *Journal of Business Research*, *69*(5), 1731–1736. https://doi.org/10.1016/j.jbusres.2015.10.046

Perkis, A., Munkeby, S., & Hillestad, O. I. (2006). A Model for Measuring Quality of Experience. In J. R. Sveinsson (Ed.), *Proceedings of the 7th Nordic Signal Processing Symposium – NORSIG 2006* (pp. 198–201). Reykjavik: IEEE. https://doi.org/10.1109/NORSIG.2006.275209

Pierucci, L. (2015). The quality of experience perspective toward 5G technology. *IEEE Wireless Communications*, *22*(4), 10–16. https://doi.org/10.1109/MWC.2015.7224722

Piaget, J. (1962). *Play, Dreams, and Imitation in Childhood*. New York: Norton.

Prensky, M. (2001). *Digital Game-Based Learning*. New York: McGraw-Hill.

Reese, D. D., Tabachnick, B. G., & Kosko, R. E. (2015). Video game learning dynamics: Actionable measures of multidimensional learning trajectories. *British Journal of Educational Technology*, *46*(1), 98–122. https://doi.org/10.1111/bjet.12128

Rice, J. W. (2007). New media resistance: Barriers to implementation of computer video games in the classroom. *Journal of Educational Multimedia and Hypermedia*, *16*(3), 249–261.

Ritzhaupt, A., Poling, N., Frey, C., & Johnson, M. (2014). A synthesis on digital games in education: What the research literature says from 2000 to 2010. *Journal of Interactive Learning Research*, *25*(2), 261–280.

Robert, L. P., & Dennis, A. R. (2005). Paradox of richness: A cognitive model of media choice. *IEEE Transactions on Professional Communication*, *48*(1), 10–21. https://doi.org/10.1109/TPC.2004.843292

Selwyn, N., & Bullon, K. (2000). Primary school children's use of ICT. *British Journal of Educational Technology*, *31*(4), 321–332. https://doi.org/10.1111/1467-8535.00165

Stewart, A. R., Harlow, D. B., & DeBacco, K. (2011). Students' experience of synchronous learning in distributed environments. *Distance Education*, *32*(3), 357–381. https://doi.org/10.1080/01587919.2011.610289

Sung, H. Y., & Hwang, G. J. (2013). A collaborative game-based learning approach to improving students' learning performance in science courses. *Computers & Education*, *63*, 43–51. https://doi.org/10.1016/j.compedu.2012.11.019

Tsuei, M. (2012). Using synchronous peer tutoring system to promote elementary students' learning in mathematics. *Computers & Education*, *58*(4), 1171–1182. https://doi.org/10.1016/j.compedu.2011.11.025

Tüzün, H., Yılmaz-Soylu, M., Karakuş, T., İnal, Y., & Kızılkaya, G. (2009). The effects of computer games on primary school students' achievement and motivation in geography learning. *Computers & Education*, *52*(1), 68–77. https://doi.org/10.1016/j.compedu.2008.06.008

Vasileva-Stojanovska, T., Vasileva, M., Malinovski, T., & Trajkovik, V. (2015). An ANFIS model of quality of experience prediction in education. *Applied Soft Computing*, *34*, 129–138. https://doi.org/10.1016/j.asoc.2015.04.047

Vygotsky, L. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Cambridge, MA: Harvard University Press.

Ward, M. E., Peters, G., & Shelley, K. (2010). Student and faculty perceptions of the quality of online learning experiences. *The International Review of Research in Open and Distributed Learning*, *11*(3), 57–77. https://doi.org/10.19173/irrodl.v11i3.867

Wu, W. H., Hsiao, H. C., Wu, P. L., Lin, C. H., & Huang, S. H. (2012). Exploring the learning-theory bases of GBL. *Journal of Computer Assisted Learning*, *28*(3), 265–279. https://doi.org/10.1111/j.1365-2729.2011.00437.x

Yuan, Z., Ghinea, G., & Muntean, G. M. (2015). Beyond multimedia adaptation: Quality of experience-aware multi-sensorial media delivery. *IEEE Transactions on Multimedia*, *17*(1), 104–117. https://doi.org/10.1109/TMM.2014.2371240

Yusoff, A., Crowder, R., & Gilbert, L. (2010). Validation of serious games attributes using the technology acceptance model. In *Games and Virtual Worlds for Serious Applications (VS-GAMES), 2010 Second International Conference on Games and Virtual Worlds for Serious Applications* (pp. 45–51). IEEE. https://doi.org/10.1109/VS-GAMES.2010.7

Zhang, D., Xu, Y., & Cheng, C. (2011). A QoE assessment system in distance education. *Engineering*, *3*(1), 90-96. https://doi.org/10.4236/eng.2011.31011

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Učenička iskustva integracije tradicionalnih igara u osnovnoškolski program

Sažetak

Iako je potencijal učenja zasnovanog na igri široko prepoznat, učinkovita integracija igara u okruženje učionice prije svega zahtijeva bolje razumijevanje učenika. Cilj ovog istraživanja jest identificirati relevantne čimbenike koji utječu na iskustva učenika prilikom integracije tradicionalnih dječjih igara u program osnovne škole. U istraživanju su sudjelovala 142 učenika iz različitih osnovnih škola, koji su pohađali veći broj sati na kojima su se koristile isključivo aktivnosti zasnovane na igri, odnosno igre tehnološki pojačane (a)sinkronim učenjem na daljinu. U sklopu istraživanja razvijen je model zasnovan na strukturnim jednadžbama, koji je testiran uz pomoć odgovora učenika, prikupljenih s pomoću anketa provođenih nakon svakog sata. Rezultati sugeriraju da na iskustvo učenika izravno utječe njihova motivacija za sudjelovanje u novom okruženju, njihovi stavovi (u vezi sa satima zasnovanim isključivo na igri), kao i tehnološka učinkovitost (u vezi sa satima koji uključuju aktivnosti zasnovane na učenju na daljinu). Također smo ustanovili da učenici različite dobi dijele slična subjektivna iskustva te identificirali jasnu razliku između stavova učenika i ishoda učenja u kontekstu igranja u učionici i (a)sinkronog učenja.

Ključne riječi: *igre u učionici; iskustvo učenika; model strukturne jednadžbe; osnovna škola; učenje zasnovano na igri.*

Uvod

Davno prije početka pisane povijesti djeca i odrasli u igri su otkrili izvor zabave i razonode. Nadalje, igra je zarana prepoznata kao potencijalno obrazovno sredstvo (Malone, 1981; Prensky, 2001; Wu, Hsiao, Wu, Lin, i Huang, 2012) koje nudi mogućnost aktivnog sudjelovanja i potiče razvoj autentičnih vježbi i zadataka, što, pak, dovodi do boljih postignuća učenika (Anzai i Simon, 1979; DuFour, DuFour, Eaker, i Many, 2006; Kirsh, 2009). Zahvaljujući tehnologiji kojom se koriste, digitalne igre nude bolji grafički prikaz, pridonose popularizaciji same prakse igranja igara među mlađom populacijom, te stvaraju potrebu za uključivanjem motivirajućih i na rješenje orijentiranih stavova kakvi su raširenи među igračima u obrazovni proces (Reese, Tabachnick i Kosko,

2015; Ritzhaupt, Poling, Frey i Johnson, 2014). Iako je potencijal učenja zasnovanog na igrama (eng. *game-based learning*, skrać. GBL) široko prepoznat, stvaranje novih, odnosno integracija postojećih igara u proces učenja (naročito u kontekstu državnog obrazovnog programa) predstavlja velik izazov, naročito stoga što teorijskim načelima često nedostaju smjernice za praktičnu primjenu (Bellotti, Kapralos, Lee, Moreno-Ger i Berta, 2013; Rice, 2007). Imajući na umu činjenicu da je dizajnerima komercijalnih računalnih igara prioritet stvaranje snažnog iskustva igranja, a ne kvalitetnog iskustva učenja, nekoliko studija istražilo je upotrebu postojećih računalnih igara koje imaju obrazovni potencijal (Boyle, Hainey, Connolly, Gray, Earp, Ott, Lim, Ninaus, Ribeiro i Pereira, 2016; Fong, 2006; Hitosugi, Schmidt i Hayashi, 2014). Suprotnost komercijalnim računalnih igrama predstavljaju računalne igre osmišljene i stvorene s obrazovnom svrhom (Burgos, Tattersall i Koper, 2007; Kafai, 2006; Moreno-Ger, Burgos, Martínez-Ortiz, Sierra i Fernández-Manjón, 2008), čiji je obrazovni sadržaj moguće dijeliti i globalizirati kako bi se pokrili troškovi njihova razvoja.

S druge strane, najnovija postignuća na području informacijske i komunikacijske tehnologije (eng. *information and communication technology*, skrać. ICT) prepoznata su kao vrijedni obrazovni alati koji mogu znatno unaprijediti proces učenja (Brun i Hinostroza, 2014; Leask i Pachler, 2013). Asinkrono učenje na daljinu podržava stvaranje radnog odnosa između učenikai nastavnikakoji su vremenski i prostorno razdvojeni (Andrade, Huang, i Bohn, 2013; Robert i Dennis, 2005; Sung i Hwang, 2013). Nasuprot tome, sinkrono učenje temelji se na interakciji koja se odvija u stvarnom vremenu i prostoru, simulirajući pritom društvenu prisutnost koja nalikuje neposrednom kontaktu (komunikaciji „licem u lice"; Kuo, Walker, Belland, Schroder i Kuo, 2014; Stewart, Harlow i DeBacco, 2011; Tsuei, 2012). Kombiniranje učenja zasnovanog na igri s učenjem na daljinu može olakšati komunikaciju među učenicima iz različitih regija; istodobno, ono poticajno djeluje na društveni razvoj, koji se, pak, odražava u izravnoj interakciji između spomenutih učenika i njihovih vršnjaka. Međutim, da bi doista bile učinkovite i korisne, tehnološke mogućnosti i integracija igara u učionicu moraju biti pažljivo usklađene.

Ovaj rad predstavlja istraživanje nastalo u sklopu tekućeg projekta zvanog „Bakine igre", koji se trenutno provodi u osnovnim školama u Makedoniji. Cilj je projekta integrirati stare, zaboravljene tradicionalne igre za djecu u svakodnevno obrazovno okruženje, te se koristiti poticajnim aktivnostima u učionici s ciljem razvoja suradnje među učenicima i promoviranja konstruktivističkog učenja. Novina ovdje predstavljenog pristupa proizlazi iz integracije konkretnih igara koje su igrala djeca, njihovi roditelji, bake i djedovi, a čije ostvarenje ne zahtijeva tehnologiju, u svakodnevni obrazovni proces unaprijeđen raznim oblicima informacijske i komunikacijske tehnologije. Pokrenut 2010. godine, projekt se temelji na eksperimentalnoj metodologiji učenja koja obuhvaća nekoliko dječjih igara koje se uklapaju u državni kurikul. Projektom je do sada obuhvaćeno 10 različitih osnovnih škola, 15 nastavnika, i oko 350 učenika. Igre su uključene u tradicionalnu učionicu uz ograničenu uporabu

tehnoloških pomagala, kao što su programi za izradu prezentacija, dokumenata i tablica, kao i jednostavne dizajn aplikacije. Kako bi se unaprijedila suradnja i proces obrade podataka, igrama su pridružene asinkrone i sinkrone aktivnosti učenja na daljinu.

Glavni cilj ovog istraživanja jest identificirati relevantne čimbenike koji utječu na potrebe i očekivanja učenika vezane uz kvalitetu u procesu integracije odabranih tradicionalnih igara u osnovnoškolski obrazovni program. Istraživanjem je identificiran niz važnih čimbenika kao što su motivacija, olakšano korištenje, stavovi učenika, tehnička svojstva primijenjene informacijske i komunikacije tehnologije, i dr., koji utječu na subjektivna očekivanja učenika, koja se, pak, manifestiraju kao kvaliteta iskustva (eng. *quality of experience*, skrać. QoE). Nadalje, istraživanje nastoji objediniti relevantne čimbenike u različitim uvjetima učenja. Polazeći od pretpostavke o povezanosti čimbenika utjecaja i kvalitete iskustva učenika, razvili smo model istraživanja koji smo dodatno testirali tokom školske godine za vrijeme izvođenja igara u učionici te u kontekstu *online* asinkronih/sinkronih uvjeta učenja.

Teorijski okvir

Igri pripada važna uloga u kognitivnom razvoju djece (Bodrova i Leong, 2003; Piaget, 1962; Vygotsky, 1978). Ona znatno pridonosi razvoju jezičnih vještina, zamišljanju i vizualizaciji ciljeva, kao i razvoju vještine rješavanja problema i socijalizacije za vrijeme igre u skupinama. Iako se Piagetov (1962) rad posvećen kognitivnom razvoju djece ne bavi izravno obrazovanjem, njegova spoznaja da djeca nabolje uče otkrivajući, aktivno istražujući i djelujući, priznata je i prepoznata u obrazovnoj praksi. Vygotsky (1978) dijeli Piagetove pretpostavke o načinima na koje djeca uče te razmatra društveni kontekst učenja kroz prizmu konstruktivističke teorije. Nadalje, on naglašava da upravo kultura djeci pruža kognitivne alate (u vidu kulturne povijesti, društvenog konteksta i jezika) nužne za razvoj, te ističe suradničko učenje, igre i simulacije kao primjere konstruktivističkih aktivnosti u učionici. Na sličan način integracija tradicionalnih igara u učionicu može ponuditi kulturne i kognitivne alate koji će poboljšati iskustvo učenika i unaprijediti proces učenja.

Iako sve veći broj istraživanja bilježi napredak i rezultate učenja zasnovanog na igri, percepciji i iskustvu učenika posvećeno je nedovoljno pozornosti (Beavis, Muspratt, i Thompson, 2015). S obzirom na njihove moguće praktične implikacije i utjecaj na učenje, proučavanje iskustva učenika iziskuje više istraživačkih napora. U tom je kontekstu primjenjivo mjerenje kvalitete iskustva, popularizirano putem istraživanja o društvenoj komponenti i očekivanjima krajnjih korisnika (Gong, Yang, Huang i Su, 2009; Pierucci, 2015; Yuan, Ghinea i Muntean, 2015; Zhang, Xu, Cheng, 2011). Donoseći zaključke o kvaliteti iskustva učenika na temelju individualnih (subjektivnih) i tehničkih (objektivnih) čimbenika, Vasileva-Stojanovska, Vasileva, Malinovski, i Trajkovik (2015) razvili su model za predviđanje kvalitete iskustva u miješanom obrazovnom okruženju orijentiranom na učenike, opremljenom odgovarajućom učionicom obogaćenom tehnologijom. Malinovski, Vasileva, Vasileva-Stojanovska

i Trajkovik (2014) opisali su model za predviđanje s pomoću kojega je moguće identificirati relevantne čimbenike koji utječu na kvalitetu iskustva učenika srednjih škola kod asinkronog i sinkronog učenja na daljinu. Međutim, usprkos dodatnim istraživačkim naporima usmjerenim na pokušaj definiranja modela kvalitete iskustva (Kilkki, 2008; Perkis, Munkeby, i Hillestad, 2006; Ward, Peters, i Shelley, 2010), niz je nedosljednosti vezanih uz čimbenike koje valja uzeti u obzir kod predviđanja kvalitete iskustva.

Budući da su u središtu ovdje predstavljenog istraživanja stare, tradicionalne igre potpomognute suvremenom računalnom tehnologijom, dio varijabli u modelu prihvaćanja tehnologije (eng. *technology acceptance model*, skrać. TAM) moguće je spojiti u modelu kvalitete iskustva učenika. Takav model pobliže određuje uzročni odnos između očekivane koristi i jednostavnosti korištenja s jedne, zatim stava i konkretnog ponašanja korisnika s druge strane, uzimajući u obzir prijemčivost korisnika za različita tehnološka rješenja (Davis, 1993; Lee, Cheung i Chen, 2005; Liu, Chen, Sun, Wible i Kuo, 2010). U nizu istraživanja pokušalo se objasniti prijemčivost korisnika i olakšanu primjenu igara u obrazovne svrhe služeći se modelom prihvaćanja tehnologije (Liang i Yeh, 2011; Pando-Garcia, Periañez-Cañadillas Charterina, 2016; Yusoff, Crowder i Gilbert, 2010). Primjerice, Bourgonjon, Valcke, Soetaert i Schellens (2010) razvili su model staze za istraživanje i predviđanje prihvaćanja videoigara u obrazovnom kontekstu od učenika, kao i procjenu učeničkog doživljaja njihove koristi, jednostavnosti korištenja i osobnog iskustva.

Nadalje, motivacija učenika prepoznata je kao ključan čimbenik koji određuje njihov angažman u obrazovnom procesu. Ističući važnost motivacije u procesu učenja zasnovanog na igri, Malone (1981) nudi osnovnu teoriju poučavanja koje počiva na intrinzičnoj motivaciji. Gradeći vlastito istraživanje na Maloneovoj teoriji, Hainey, Westera, Connolly, Boyle, Baxter, Beeby i Soflano (2013) ocjenjuju motivaciju i stavove učenika prema igranju igara i njihovoj uporabi u obrazovnom kontekstu, te jasno ilustriraju razliku među stavovima učenika u kontekstu redovnog i obrazovanja na daljini. U nizu istraživanja kojima se ispituje utjecaj računalnih igara na motivaciju i učenje (Erhel i Jamet, 2013; Hanus i Fox, 2015; Tüzün, Yılmaz-Soylu, Karakuş, İnal i Kızılkaya, 2009) napominje se da uključivanje učenja zasnovanog na igri u obrazovni kontekst iziskuje mnogo pažnje.

Ovdje predstavljeno istraživanje ističe važnost motivacijskih aspekata prisutnih za vrijeme učenja zasnovanog na igri i učinkovitosti primijenjene tehnologije, te kombinira te čimbenike s odabranim varijablama modela prihvaćanja tehnologije (olakšano korištenje i stavovi koji utječu na namjeravano ponašanje). Nadalje, istraživanjem su definirani oni čimbenici koji utječu na subjektivnu kvalitetu iskustva učenika osnovnih škola za vrijeme integracije tradicionalnih igara u školski kurikul. Formulirani su objedinjeni konstrukti kojima se moguće koristiti u okruženju za učenje zasnovanom isključivo na igri ili dopunjenom aktivnostima učenja na daljinu. Mogućnost predviđanja pozitivnih ishoda u sličnim obrazovnim kontekstima zasnovanim na igri može biti od koristi obrazovnim institucijama koje namjeravaju

integrirati tradicionalne igre u svojstvu sredstva učenja u njihove kurikule pri anticipaciji kvalitete iskustva učenika, a možda i unaprjeđivanju ishoda učenja.

Metodologija

Ispitanici

U istraživanju je sudjelovalo 142 učenika iz pet osnovnih škola u Makedoniji (uključenih u projekt „Bakine igre") koji su pokazali zanimanje za uključivanje razrednih igara u proces učenja. Činjenica da se spomenute škole nalaze u raznim gradovima i selima diljem zemlje, omogućila nam je da u istraživanje uključimo učenike iz urbanih i ruralnih sredina. Kako bi se ispitala kvaliteta iskustva učenika raznih dobi, za sudjelovanje u istraživanju odabrani su učenici različitih razreda osnovnih škola, točnije 2./3. (učenici u dobi od 7 do 8 godina) i 6./7. razreda (od 11 do 12 godina). Sate organizirane oko učenja zasnovanog na igri održalo je devet nastavnika koji su pokazali sposobnost i spremnost na modificiranje uobičajene nastavne prakse i sustavno integriranje tradicionalnih igara u okruženje za učenje.

Dizajn istraživanja

Iako nam je na raspolaganju bilo mnoštvo komercijalnih obrazovnih igara namijenjenih učenicima osnovnih škola, za potrebe ovog istraživanja odabrali smo stare, tradicionalne igre za djecu iz naše regije. Odabrali smo one igre koje se uklapaju u državni kurikul za različite školske predmete, te ih obogatili tehnologijom i aktivnostima učenja na daljinu.

U sklopu ovdje predstavljenog istraživanja izvršena je analiza obrazovnog potencijala odabranih tradicionalnih igara, kao i predmeta i tematskih cjelina iz nacionalnog kurikula za osnovne škole koje bi se tim igrama mogle koristiti. Istraživanjem su obuhvaćena tri različita školska predmeta i po dvije igre za svaku tematsku cjelinu unutar pojedinog predmeta. Igre su ravnomjerno raspoređene među školama koje su sudjelovale u istraživanju i izvođene tijekom cijele školske godine. Tablica 1 donosi popis tradicionalnih igara razvrstanih prema predmetima u koji su uključene, detaljne upute za njihovo izvođenje, ciljne vještine i ciljeve učenja.

Kako bi se smanjio utjecaj subjektivne naklonosti učenika prema pojedinim predmetima, istraživanjem su obuhvaćeni različiti školski predmeti. Rezultati stoga mogu pridati veći statistički značaj doživljaju igre od učenika pod različitim uvjetima.

Nadalje, u nastojanju da bolje razumijemo uvjerenja učenika za vrijeme procesa integracije razrednih igara u program osnovnih škola i ispitamo mogućnosti kombiniranja učenja na daljinu i učenja zasnovanog na igri, istraživanjem smo obuhvatili tri različite nastavne prakse:

- sati organizirani isključivo oko aktivnosti zasnovanih na igrama, pri čemu svaki sat uključuje jednu od šest odabranih tradicionalnih igara; u realizaciji igre koriste se tehnološka pomagala kao što su programi za izradu prezentacija, dokumenata i tablica, kao i jednostavne dizajn aplikacije;

- sati utemeljeni na asinkronom učenju: za svaku od šest odabranih igara nastavnici pripremaju *online* materijale, upute i nastavne planove koje su već koristili u nastavi. Svi materijali su unaprijed dostupni, što učenicima omogućava da se samostalno pripremaju za nastavu i uče kod kuće: odgovorni su za organizaciju vlastitog učenja (u slučaju mlađih učenika, učenje kod kuće organizira se uz pomoć roditelja), a nastavnike kontaktiraju po potrebi. Sam školski sat sastoji se od kratkog pregleda kontinuiranog internetskog prijenosa (eng. *streaming*) i ponavljanja sadržaja;
- sati koji obuhvaćaju videokonferenciju organiziranu u suradnji dviju osnovnih škola iz različitih regija. Aktivnosti zasnovane na igrama realizirane su u suradnji učenika koji žele „učiti djelovanjem" i djece iz druge škole. Suradnja se odvija pod odgovarajućim nadzorom nastavnika.

Tablica 1

Odabrane tradicionalne igre razvrstane prema predmetima, upute i ciljne vještine

Igra	Upute	Predmet	Vještine
Školica	Na podu se iscrtava geometrijski oblik podijeljen na osam posebno dizajniranih polja. Svako polje označeno je brojem od 1 do 8. Igrač baca kamenčić u svako polje (od najmanje prema najvećoj brojčanoj vrijednosti). Ako kamenčić padne unutar polja, igrač skače na jednoj nozi kroz svako pojedino polje dok ne stigne do onog s kamenčićem. Igrač dodaje broj polja svom ukupnom rezultatu (ili izvodi druge matematičke operacije). Igrač ne smije stati na crtu; također, kamenčić ne smije pasti na crtu. U slučaju netočnog rezultata, igrač čeka na svoj red dok ostali igrači pokušavaju „osvojiti" sva polja.	Matematika	aritmetičke operacije, računanje, razumijevanje geometrijskih oblika
Kutija šibica	Na svaku stranu prazne kutije šibica ispisuje se broj. Kutija se potom postavlja na rub stola. Igrači naizmjence udaraju vanjsku stranu kutije svojim palčevima. Kutija leti u zrak a nakon što sleti, igrači dodaju broj ispisan na gornjoj strani svom ukupnom rezultatu (ili se njime koriste u nekoj drugoj računalnoj operaciji). Ako je rezultat matematičke operacije pogrešan, drugi igrači taj isti broj oduzimaju od ukupnog rezultata igrača koji je pogriješio (ili se koriste tim brojem u nekoj drugoj računalnoj operaciji). Igra traje unaprijed određen broj krugova (najčešće pet). Pobjeđuje igrač s najvećim ukupnim zbrojem.	Matematika	aritmetičke operacije i računanje
Dama	Dva se igrača natječu slažući kamenčiću u skladu s unaprijed definiranom shemom kako bi stvorili „damu". Sheme se izrađuju s pomoću različitih materijala kao što su papir, tijesto ili glina. Svaki igrač ima devet kamenčića koje nastoji složiti u horizontalne ili vertikalne redove od tri kamenčića, prateći shemu.	Likovna kultura	upoznavanje materijala, stvaranje šara i predložaka nadahnutih folklorom

Uže	Igrači stvaraju razne oblike savijajući i okrećući uže od konoplje (duljine oko 60 cm i s krajevima vezanim u čvorove) oko prstiju. Dobiveni oblici pokazuju se nastavniku i drugim igračima.	Likovna kultura	razumijevanje simetrije, paralelnih crta i dimenzija
Skrivača	Igrači – po mogućnosti s komadima narodnih nošnji na sebi – tvore krug držeći se za ruke. Jedan igrač stoji u sredini kruga, s povezom preko očiju. Ostali igrači pjevaju i plešu oko njega. U trenutku kad se krug prestane micati, igrač u središtu kreće prema nasumce odabranom članu kruga i pokušava pogoditi njegovo ime koristeći se osjetilom dodira i mirisa, kao i komad narodne nošnje.	Priroda i društvo	prepoznavanje individualnih sličnosti i različitosti, razvoj mentalnih vještina
Džamija	Pet plosnatih kamenčića slažu se jedan na drugi u obliku tornja. Igrači su podijeljeni u dvije skupine. Zadaća prve skupine jest srušiti toranj bacanjem lopte s udaljenosti od oko 2 do 3 metra. Ako u tome uspiju, druga će skupina pokušati obnoviti toranj. Članovi prve skupine nastoje ih u tome spriječiti gađajući ih loptom. Igrač pogođen loptom mora napustiti igru. Pobjeđuje skupina koja u zadanom vremenu uspije obnoviti toranj.	Priroda i društvo	prepoznavanje raznih emocija poput empatije, prijateljstva, povjerenja, ali i ljutnje, neprijateljstva, neugode i dr.

Sati organizirani isključivo oko aktivnosti zasnovanih na igrama omogućili su nam da promotrimo što se događa kada se tradicionalne igre uključe u okruženje utemeljeno na izravnoj interakciji („licem u lice"). U sklopu sati utemeljenih na asinkronom učenju učenici su imali priliku gledati snimke učenja zasnovanog na igri (većina igara koje su se koristile dokumentirana je i snimljena) kod kuće, što im je omogućilo da obrađuju veće količine podataka. Sinkrono učenje putem videokonferencije omogućilo je dvjema osnovnim školama da udruže vlastite (intelektualne i materijalne) resurse i zajednički organiziraju školski sat.

Da usustavimo: za trajanja školske godine organizirano je osamnaest školskih sati posvećenih različitim temama koje se obrađuju u sklopu tri školska predmeta. Na pojedinim satima koristile su se odgovarajuće varijacije odabranih igara, kako bi se rezultati mogli usporediti. Primjerice, u nastavi matematike obrađene su sljedeće tematske cjeline: zbrajanje (sat zasnovan na igri za učenike 2./3. razreda), oduzimanje (asinkrono učenje), oduzimanje i zbrajanje (videokonferencija). Uspješnost učenika mjerena je nakon svakog sata, što nam je omogućilo da kovariramo njihove rezultate na polju kvalitete iskustva i ostvarenih ciljeva učenja.

Statističke metode

Iako je kvaliteta iskustva učenika od ključne važnosti za obrazovni proces, teško je pronaći odgovarajući način kojim bi se predvidjelo, kvantificiralo i izmjerilo njihova uvjerenja i očekivanja. Analiza faktora potvrde (eng. *confirmatory factor analysis*, skrać. CFA) statistička je metoda (Jöreskog i Sörbom, 1984) kojom se definira veći

broj promatranih varijabli koje je moguće procijeniti i mjeriti. Pritom se izdvajaju složene varijable koje nisu promatrane (poput subjektivne kvalitete iskustva), poznate kao latentni konstrukti. Na sličan način, McIver i Carmines (1981), zatim Nunnally i Bernstein (1994) objašnjavaju zašto su za mjerenje složenih konstrukata primjerenija višedimenzionalna (tj. mjerenja s više elemenata) nego jednodimenzionalna mjerenja (tj. mjerenja s jednim elementom). U metodološkom smislu, strukturno modeliranje, tj. model zasnovan na strukturnim jednadžbama (eng. *structural equation modelling*, skrać. SEM) istraživačima može pomoći u pronalaženju odgovora na razna pitanja (Bollen, 1998), kao i ponuditi model koji predstavlja uzročne veze među različitim latentnim konstruktima kao što su čimbenici koji utječu na iskustvo učenika tijekom integracije igara u programe osnovnih škola. Budući da visoka razina pouzdanja prisutna u SEM modelima omogućava adekvatno pokrivanje čimbenika koji izostaju iz analize latentnim konstruktima, za potrebe ovog istraživanja odabrano je upravo strukturno modeliranje. Za provođenja statističkih usporedbi i preciznog lociranja razlike u učeničkim rezultatima ostvarenima u trima nastavnim praksama, uz SEM se koristio i Kruskal-Wallisov test (Kruskal i Wallis, 1952), neparametarski ekvivalent jednosmjerne analize varijance. Rezultati modela kvalitete iskustva učenika i ocjena njihovih rezultata otvaraju prostor za uspoređivanje iskustva učenika i rezultata učenja u različitim uvjetima.

Metodološki aparat

Budući da je glavni cilj istraživanja razviti model koji na odgovarajući način predstavlja čimbenike koji utječu na kvalitetu iskustva učenika za vrijeme integracije tradicionalnih igara u kurikul osnovne škole, sastavili smo upitnik kojim su nakon svakog sata bilježena mišljenja učenika (u vidu višedjelnih mjera) vezana uz odabrane konstrukte. Upitnik se temelji na našim iskustvima za vrijeme trajanja projekta „Bakine igre" i na predstavljenom teorijskom okviru. Metodološki aparat opisan je niže (s odgovarajućim modifikacijama za pojedina okruženja za učenje).

Učinkovitost tehnologije

Školski sati u kojima su se koristile aktivnosti učenja na daljinu oslanjaju se na određena tehnološka pomagala koja učenici mogu doživjeti na različite načine. Iako današnja djeca rado igraju igre (Bourgonjoj i sur., 2010; Prensky, 2001) i slove kao sofisticirani i upućeni konzumenti informacijskih i računalnih tehnologija (Prensky, 2001; Selwyn i Bullon, 2000), izvođenje igara u kontekstu učionice i uz pomoć raznih tehnoloških pomagala ne mora nužno postići pozitivne rezultate. Stoga prvi dio upitnika sadrži standardne čestice vezane uz učinkovitost tehnologije u aktivnostima utemeljenim na učenju na daljinu (usp. Vasileva-Stojanovska i sur., 2015), koje uključuju (između ostaloga) pitanja o kvaliteti audio/video signala i njihovoj međusobnoj sinkronizaciji. Taj dio izostaje iz upitnika vezanog uz aktivnosti zasnovane isključivo na igrama.

Olakšano korištenje, stav i motivacija

Kao što su pokazala dosadašnja istraživanja (Bourgonjon i sur., 2010; Lee, Cheung i Chen, 2005; Liang i Yeh, 2011; Liu i sur., 2010; Sung i Hwang, 2013; Ward, Peters i Shelley, 2010; Yusoff, Crowder i Gilbert, 2010), odnos između latentnih konstrukata koji izražavaju olakšano korištenje i stavove prema novih tehnologijama, kao i motivaciju i razinu zadovoljstva (Erhel i Jamet, 2013; Hainey i sur., 2013; Tüzün i sur., 2009), može imati znatne prednosti. Drugi dio upitnika stoga sadrži čestice preuzete iz studija utemeljenih na modelu prihvaćanja tehnologija (Bourgonjoj i sur., 2010: Liang i Yeh, 2011; Liu i sur., 2010; Yusoff, Crowder i Gilbert, 2010) sa svrhom promišljanja o olakšanom korištenju koje se manifestira kao uvjerenja učenika vezana uz odnos na relaciji nastavnik – učenik i razumljivost sadržaja, što neizravno povezuje rad nastavnika s višedimenzionalnim kovarijatima prezentacije igara. Slično tomu, naredni dio upitnika ispituje čestice vezane uz stavove učenika prema novim pristupima poučavanju. Slijedi ga dio koji prilagođenom motivacijskom skalom mjeri motivaciju učenika za igranje igara i njihovo korištenje u obrazovnom okruženju (Erhel i Jamet, 2013; Hainey i sur., 2013; Hanus i Fox, 2015; Malone, 1981; Tüzün i sur., 2009).

Kvaliteta iskustva

Posljednji dio upitnika preuzima elemente iz postojećih istraživanja kvalitete iskustva (Malinovski i sur., 2014; Vasileva-Stojanovska i sur., 2015; Ward, Peters i Shelley, 2010) sa svrhom prikupljanja subjektivnog iskustva učenika i njihovih očekivanja vezanih uz uvođenje tradicionalnih igara u učionicu. Taj dio stoga ispituje uvjerenja učenika vezana uz učinkovitost i produktivnost u razredu, njihovo uživanje i cjelokupni doživljaj te vrste školskih aktivnosti.

Dob učenika

Budući da dob ima značajnu ulogu u psihološkom, emocionalnom i kognitivnom razvoju djece (Prensky, 2001; Vygotsky, 1978), integracija igara u kurikul osnovnih škola može ovisiti o dobi učenika. Ovdje predstavljena analiza stoga uključuje učeničku dob i poslije je povezuje s drugim konstruktima i česticama upitnika.

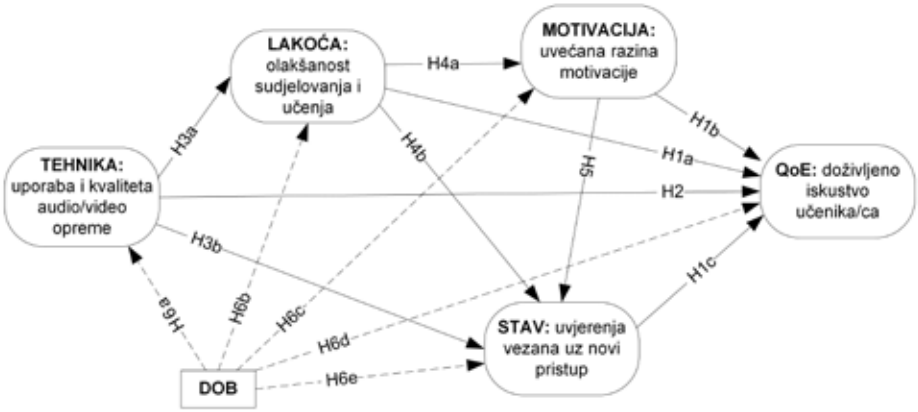
Tablica 2 donosi popis čestica upitnika: svako pitanje predstavlja varijablu istraživanja kao jedan od pokazatelja odabranih konstrukata, s nužnom razlikom za pojedine uvjete učenja. Nakon svakog školskog sata, učenici odgovarali su na pitanja s pomoću Likertove ljestvice s pet elemenata (Likert, 1931), grafički prikazane s pomoću pet lica različitih izraza (lice širokog osmijeha odgovara ocjeni pet, a tužno lice odgovara ocjeni jedan). Vlastite stavove i uvjerenja djeca su izražavala zaokruživanjem odgovarajućeg lica.

Tablica 2

Čestice upitnika, latentni konstrukti i njihovi pokazatelji

Čestica upitnika	Konstrukt	Pokazatelj
Ocijeni kvalitetu videosignala.	TEHNIKA	Tehn1
Ocijeni kvalitetu audiosignala.		Tehn1
Jesu li zvuk i slika bili usklađeni?		Tehn1
Je li oprema*/prikaz kontinuiranog internetskog sadržaja** bila ispravna?		Tehn1
Jesi li bez problema mogao pratiti nastavu?	LAKOĆA	Lakoća1
Ocijeni interakciju s nastavnikom*/upute za rad.		Lakoća2
Jesi li razumio kontekst?		Lakoća3
Je li prirodno igrati se u sklopu nastave?		Lakoća4
Sviđa li ti se ovaj način poučavanja?	STAV	Stav1
Želiš li u budućnosti sudjelovati u još ovakvih sati?		Stav2
Sviđaju li ti se noviteti u nastavi?		Stav3
Je li te sudjelovanje u igri potaknulo da dovršiš zadatak?	MOTIVACIJA	Motiv1
Bi li potaknuo druge učenike da sudjeluju u ovakvom satu?		Motiv2
Hoćeš li igrati iste igre kada budeš učio kod kuće?		Motiv3
Hoćeš li sam igrati ove igre za učenje?		Motiv4
Što misliš, jesu li ti igre pomogle da bolje razumiješ gradivo?	QoE	QoE1
Je li igra otvorila nove i vrijedne mogućnosti učenja?		QoE2
Nudi li ovaj tip nastave zanimljivije i uspješnije mogućnosti učenja?		QoE3
Kakvo je tvoje iskustvo ovakvog tipa nastavne aktivnosti?		QoE4

Napomena. Varijacije za različite pristupe poučavanju: * = sinkrono poučavanje ili nastava zasnovana isključivo na igrama, ** = asinkrono poučavanje



Prikaz 1. Model istraživanja koji prikazuje doživljaj učenika za vrijeme integracije igara u osnovnoškolski program

Prikaz 1 ilustrira predloženi model kvalitete iskustva, utemeljen na predstavljenom teorijskom okviru, na odabranim varijablama i odnosima modela prihvaćanja tehnologije, kao i na istraživačkom instrumentariju. Ostatak ovdje predstavljenog istraživanja temelji se na tom modelu. Budući da razlike u dobi učenika mogu dovesti do različitih rezultata, model uključuje moderirajuću varijablu dobi. Istraživanje

se stoga oslanja na strukturno modeliranje kako bi se analizirali odgovori učenika na pitanja iz upitnika nakon svakog sata i kako bi se utvrdile statistički značajne vrijednosti konstrukata predloženog modela kvalitete iskustva, uključujući pogreške mjerenja u analizi.

Rezultati

Deskriptivna statistika

142 učenika i učenica koji su sudjelovali u istraživanju pohađali su dva školska sata posvećena odabranim predmetima, u kojima su primijenjena tri tipa nastavne prakse. Nastava je organizirana za vrijeme trajanja cijele školske godine, no zbog nužnosti pohađanja redovne nastave, učenici nisu mogli sudjelovati u svim satima. Umjesto toga, svaki je učenik u prosjeku sudjelovao na barem pet do šest sati za svaku od tri nastavne prakse. Prikupljeni demografski podatci pokazuju da je među sudionicima istraživanja 53,5% učenika i 46,5% učenica, 29,6% dvanaestogodišnjaka, 28,4% jedanaestogodišnjaka, 23,5% osmogodišnjaka i 18,5% sedmogodišnjaka. U istraživanju su sudjelovali učenici viših i nižih razreda. 66% učenika živi u manjim i većim gradovima, a njih 34% živi u selima.

Za sate zasnovane isključivo na igri prikupljen je 721 učenički odgovor, za sate u kojima su igrama pridodane asinkrone aktivnosti 713 odgovora, a za sate koji su uključivali videokonferencije 709 odgovora. Prije provođenja analize faktora potvrde, ispitali smo prirodu učeničkih odgovora nakon svakog tipa nastavne prakse i usporedili mjere pojedinih varijabli radi dobivanja srednje vrijednosti i standardnog odstupanja (tablica 3).

Tablica 3

Opisni rezultati pokazuju da je za većinu varijabli razina pozitivnog iskustva učenika bila nešto viša u slučaju sati zasnovanih isključivo na igrama nego sati s aktivnostima učenja na daljinu, koji su ostvarili najnižu srednju vrijednost za tehničke indikatore. Međutim, ilustriranje odnosa između latentnih konstrukata i njihova izravnog utjecaja na kvalitetu iskustva učenika iziskivalo je dodatnu analizu. Opisni rezultati uključuju zadovoljavajuće standardno odstupanje koje pokazuje da su odgovori učenika bili konstruktivni.

Početna analiza stoga je nastavljena, pri čemu se kao test pouzdanosti tehnike za ispitivanje unutarnje konzistentnosti promatranih varijabli kojima je mjeren temeljni konstrukt koristila Cronbachova alfa (Cronbach, 1951). Alfa test donio je značajne rezultate (tablica 4). Procjena vrijednosti Cronbachove alfe kreće se u rasponu od 0 do 1, pri čemu povećanje iznosa u pravilu prati uvećanje korelacije među elementima. Budući da vrijednosti alfe za konstrukte koji premašuju 0,7 upućuju na dobru unutarnju konzistentnost elemenata ljestvice (Nunnally i Bernstein, 1994), rezultati sugeriraju da se ti podatci mogu koristiti u daljnjoj analizi faktora i testiranju modela.

Tablica 4

Model mjerenja

Budući da istraživanja u društvenim znanostima koja se bave složenim temama ne mogu obuhvatiti sve moguće čimbenike, nužno je razviti model mjerenja koji povezuje mjerene varijable (pokazatelje) i latentne varijable (konstrukte), te uključuje pogreške mjerenja. Na taj bi način bilo moguće obuhvatiti čimbenike koji nedostaju, a koji utječu na rezultate, koristeći se varijablama koje su dio istraživanog modela. Budući da su pretpostavke o normalnoj multivarijantnosti ispunjenje na odgovarajući način, razvili smo model mjerenja na temelju građe prikupljene iz odgovora učenika kako bismo ispitali faktorska opterećenja između latentnih varijabli i predloženih promatranih indikatora, imajući na umu da bi standardizirani iznosi procijenjenog faktorskog opterećenja trebali iznositi 0,50 ili više (idealno 0,70 ili više; Nunnally i Bernstein, 1994). Nadalje, pouzdanost varijabli i konvergentne valjanosti mjereni su s pomoću izvedene prosječne varijance (eng. *average variance extracted*, skrać. AVE) i pouzdanosti konstrukta (eng. *construct reliability*, skrać. CR). Pouzdanost konstrukta u prosjeku bi trebala iznositi barem 0,70 (vrijednosti između 0,60 i 0,70 prihvatljive su samo ako su drugi pokazatelji konstrukta valjanosti modela dobri), a izvedena bi prosječna varijanca trebala iznositi barem 0,50, budući da niže vrijednosti sugeriraju da je u česticama veća greška nego varijanca koja se tumači latentnom strukturom. Model mjerenja donio je rezultate u kojima faktorsko opterećenje za sve pokazatelje premašuje idealni iznos od 0,70. Jedine su iznimke čestice Stav3 i QoE3 za sate zasnovane isključivo na igrama, i Lakoća4 za sate koji uključuju videokonferenciju (iznosi su i dalje > 0,50). Dobivene vrijednosti za pouzdanost konstrukta i izvedenu prosječnu varijancu prikazane su u tablici 5.

Tablica 5

Rezultati pokazuju da sve vrijednosti pouzdanosti konstrukta premašuju 0,70, osim u slučaju konstrukta kvalitete iskustva za sate zasnovane isključivo na igrama (rezultati su i dalje prihvatljivi), a sve vrijednosti izvedene prosječne varijance premašuju željeni iznos od 0,50. Model mjerenja za svaku od tri nastavne prakse stoga je ponudio relevantne standardizirane procjene faktorskih opterećenja između latentnih varijabli i predloženih promatranih pokazatelja s dovoljnom pouzdanošću i valjanošću konvergencije.

Promatrajući standardizirane rezidualne kovarijance i indekse modifikacije, primijetili smo da neki pokazatelji (Motiv4 za sate zasnovane na igrama, Lakoća4 i Tehnika4 za sate s asinkronim aktivnostima, i Lakoća4 za sate s videokonferencijom) i njima pripadajuće pogreške u mjerenju pokazuju visoke vrijednosti kovarijance u pripadajućim modelima (Hair, Anderson, Tatham, i Black, 1998). Stoga smo u obzir uzeli mogućnost uklanjanja tih čimbenika s ciljem osiguravanja bolje prilagođenosti modela u narednim koracima analize.

Strukturni model

Razvili smo strukturni model s ciljem utvrđivanja valjanosti predloženog modela istraživanja, koji ilustrira čimbenike koji utječu na iskustvo učenika za vrijeme integracije igara u programe osnovnih škola (Prikaz 1), kao i njegove kompatibilnosti s podatcima istraživanja u bilo kojoj situaciji. Budući da se modeli zasnovani na strukturnim jednadžbama ne oslanjaju na jedinstvena statistička testiranja kojima bi bilo moguće prikazati valjanost rezultata, svaki pojedini model mora zadovoljiti višestruke indekse slaganja, koji uključuju barem sljedeće elemente: relativni omjer Hi kvadrata i stupnjeva slobode (CMIN/df) u kojem vrijednosti u rasponu od dva do pet upućuju na dobro slaganje (Marsh i Hocevar, 1985); indeks slaganja (eng. *goodness of fit indeks*, skrać. GFI); komparativni indeks slaganja (eng. *comparative fit index*, skrać. CFI) i normirani indeks slaganja (eng. *normed fit index*, skrać. NFI) u kojima bi sve vrijednosti trebale premašivati preporučeni minimum od 0,9 (Bentler i Bonett, 1980; Hu i Bentler, 1999; Jöreskog i Sörbom, 1984); i drugi korijen srednje vrijednosti kvadrirane pogreške aproksimacije (eng. *root mean square error of approximation*, skrać. RMSEA) u kojem su poželjnije vrijednosti manje od 0,08 (Browne i Cudeck, 1993).

Imajući na umu činjenicu da je analiza mjere otkrila koje je pokazatelje moguće ukloniti sa svrhom rafiniranja modela (Motiv4 za sate zasnovane na igri, Lakoća4 i Tehn4 za sate s dodanim asinkronim aktivnostima i Lakoća4 za sinkrone aktivnosti učenja na daljinu), testirali smo potrebne indekse slaganja modela s tim pokazateljima i bez njih (tablica 6).

Tablica 6

Rezultati pokazuju da su indeksi slaganja poboljšani u procesu rafiniranja modela, te da su pritom ostvarili vrijednosti koje zadovoljavaju navedene zahtjeve. Stoga smo uveli potrebne promjene i preradili model zasnovan na strukturnim jednadžbama koji ilustrira složene odnose među istraživanim konstruktima za vrijeme sati zasnovanih isključivo na igrama (prikaz 2).

Prikaz 2

Predstavljeni rezultati pokazuju da je uz pomoć R2 u iznosu od 0.99 moguće predvidjeti kvalitetu iskustva učenika za nastavu koja uključuje tradicionalne igre. Spomenuta kvaliteta najvećim je djelom određena varijablama MOTIVACIJE (β=0,61, p<0,001) i STAVA (β=0,48, p<0,001). Rezultati analize također upućuju na snažnu izravnu vezu između LAKOĆE/MOTIVACIJE (β=0,82, p<0,001) s jedne i MOTIVACIJE/STAVA (β=0,72, p<0,001) s druge strane. Međutim, nije ustanovljena izravna i statistički značajna veza između LAKOĆE/QoE i LAKOĆE/STAVA (koji iznosi p>0.05). Razlike u dobi učenika nisu imale značajan utjecaj u ovome modelu budući da uzajamne veze postoje samo između DOBI i LAKOĆE (β=0,61, p=0,001), a ostali putovi (DOB/STAV, DOB/MOTIVACIJA, DOB/QoE) za koje je zabilježen iznos p>0,05 nemaju značajan utjecaj.

U skladu s otkrićem do kojega smo došli za vrijeme analize mjera, preradili smo i model zasnovan na strukturnim jednadžbama, koji prikazuje značajne strukturne veze između latentnih varijabli za sate zasnovane na igri dopunjene (a)sinkronim aktivnostima učenja na daljinu (prikaz 3).

Prikaz 3

Rezultati strukturnog modeliranja za sate na kojima se učenje zasnovano na igri kombinira s aktivnostima učenja na daljinu ukazuju na slično ponašanje asinkronih i sinkronih dodataka, te objašnjavaju iznos R2 od 0,92 za konstrukt kvalitete iskustva. Rezultati sugeriraju da taj konstrukt u značajnoj mjeri određuju latentne varijable MOTIVACIJE (β=0,61/0,53 za a/sinkr., p<0,001) i TEHNIKE (β=0,09/0,10 za a/sink., p<0,001). Varijabla LAKOĆE koja izravno utječe na kvalitetu iskustva za vrijeme videokonferencija i igranja (β=0,20, p<0,001) ponaša se drugačije, no ne pokazuje se statistički značajnom za vrijeme asinkronih aktivnosti (p>0,05). To se doima logičnim budući da učenici osnovnih škola ovise o interakciji s nastavnicima i olakšanom sudjelovanju za vrijeme videokonferencija koje se katkad zanemaruje kod asinkronog učenja. Putovi između DOBI/QoE i STAVA/QoE iznose p>0,05, što nema značajniji utjecaj u analizi kvalitete iskustva tih učenika.

Nadalje, rezultati ukazuju na izravne utjecaje između sljedećih varijabli: MOTIVACIJA/STAV (β=0,81/0,83 za a/sinkr., p<0,001), LAKOĆA/MOTIVACIJA (β=0,71/0,78 za a/sinkr., p<0,001), LAKOĆA/STAV (β=0,21/0,16 za a/sinkr., p<0,001) i TEHNIKA/LAKOĆA (β=0,54/0,44 za a/sinkr., p<0,001). Dob učenika pokazala se važnom na putovima između DOBI/TEHNIKE (β=-0,39/-0,13 za a/sinkr., p<0,001), DOBI/LAKOĆE (β=0,18/-0,15 za a/sinkr., p<0,001) i DOBI/MOTIVACIJE (β=-0,18 za a/sinkr., p<0,001 i β=-0,08 za a/sinkr., p=0,005). Tehnologija i dob nisu izravno utjecali na stavove učenika budući da je za varijable TEHNIKA/STAV i DOB/STAV zabilježena vrijednost p>0,05.

QoE i rezultati učenja

Nakon svakog sata nastavnici su ocjenjivali učenike na bodovnoj ljestvici od 1 (slabo) do 5 (izvrsno), na temelju njihova interesa, interaktivnosti i rezultata testova. Rezultati tog ocjenjivanja omogućili su nam da ispitamo statističke razlike u rezultatima učenja na satima zasnovanim isključivo na igrama ili igrama kojima su pridružene (a) sinkrone aktivnosti učenja na daljinu. Na temelju toga definirali smo tri varijable ovisne o rezultatima: interes, interaktivnost i rezultat testiranja, s nastavnom praksom kao varijablom grupiranja. Svaka od varijabli podvrgnuta je Kruskal-Wallisovu testu sa svrhom preciznog lociranja razlike među rezultatima učenika s obzirom na nastavnu praksu. Opisni statistički podatci vezani uz rezultate učenja prikazani su u tablici 7, a tablica 8 donosi rezultate Kruskal-Wallisova testa prema parovima nastavnih praksi, provedenog na razini pouzdanosti od 95%.

Tablica 7 i 8

Rezultati sugeriraju da je razlika u rezultatima koje su postigli učenici statistički značajna za sate zasnovane na igrama i sate s dodanim (a)sinkronim aktivnostima ($p<0,05$). Rezultati ne pokazuju statistički značajnu razliku ($p>0,05$) u rezultatima ostvarenima na satima s aktivnostima (a)sinkronog učenja. Posljedica toga je da ti rezultati slijede jasnu razliku između kvalitete iskustva učenika za vrijeme provođenja igara u učionici i učenja na daljinu, što kovarira varijable strukturnog modela i subjektivnog iskustva učenika s rezultatima učenja.

Rasprava

Ovdje predstavljeno istraživanje nudi jedinstven model za mjerenje kvalitete iskustva za vrijeme integracije tradicionalnih igara u osnovnoškolski program. Rezultati istraživanja sugeriraju da se čimbenici koji utječu na kvalitetu iskustva mogu podijeliti u dvije kategorije:

- važni čimbenici (vezani uz motivaciju i stav) vezani za sate u kojima se učenje zasnovano na igri uvodi u tradicionalno okruženje za učenje;
- čimbenici koji utječu na sate koji uključuju tradicionalne igre kojima su pridodane aktivnosti zasnovane na učenju na daljinu. Spomenuti čimbenici uvjetovani su motivacijom učenika i tehnološkim uvjetima u (a)sinkronom okruženju za učenje, kao i olakšanom primjenom na satima koji uključuju videokonferenciju.

Navedeni rezultati u skladu su s onima koje opisuju Hainey i sur. (2013), a koji ilustriraju jasnu razliku između stavova učenika u kontekstu tradicionalnog i obrazovanja na daljinu. Nadalje, naši rezultati pokazuju iskustvo učenika i kvalitetu očekivanja u kontekstu igranja u učionici, kao i (a)sinkronih uvjeta učenja koji uključuju tradicionalne igre. Konkretno, razina uvjerenja učenika vezana uz učenje uz zabavu (QoE3) vidno smanjuje kvalitetu iskustva u kontekstu igranja u učionici, a cjelokupno zadovoljstvo učenika (QoE4) predstavlja najviši čimbenik regresije za vrijeme (a)sinkronih uvjeta učenja. Primjena tradicionalnih igara u tradicionalnoj učionici ponajprije je doživljena kao zabavna i zanimljiva aktivnost u kontekstu tradicionalne nastavne prakse, a cjelokupno iskustvo učenika pokazalo se kao najvažniji čimbenik u slučaju kombiniranja pristupa zasnovanog na učenju na daljinu s učenjem zasnovanim na igri.

Dobiveni rezultati potvrđuju spoznaje postojećih istraživanja (Erhel i Jamet, 2013; Hainey i sur., 2013; Malinovski i sur., 2014; Malone, 1981; Tüzün i sur., 2009) koje ističu važnost učeničke motivacije za vrijeme učenja zasnovanog na igri te objašnjavaju dodatne latentne poveznice koje utječu na kvalitetu iskustva učenika. Ostavljajući po strani odabranu nastavnu praksu, motivacijski aspekti pokazali su se kao čimbenik s najvećim utjecajem na iskustvo učenika. Primjerice, tradicionalne igre školice ili šibica uključene u nastavu matematike motivirale su učenike da aktivno sudjeluju u izvođenju aritmetičkih operacija, što je izravno uvećalo njihovu kvalitetu iskustva. Nadalje, rezultati pokazuju da iako današnju djecu smatramo sofisticiranim i upućenim konzumentima informacijske i komunikacijske tehnologije (Selwyn i

Bullon, 2000; Prensky, 2001), ona u mlađoj dobi nisu u stanju intuitivno kompenzirati varijacije u tehničkoj kvaliteti za vrijeme aktivnosti učenja na daljinu, tako da je učinkovitost tehnologije za vrijeme interaktivnih sati, odnosno sati koji uključuju kontinuirani internetski prijenos utjecala na iskustvo učenika. Stoga bi se u slučajevima kombiniranja tradicionalnih igara i učenja zasnovanog na igri s učenjem na daljinu odgovarajuća tehnička podrška morala unaprijed osigurati. S druge strane, varijacije u dobi učenika nisu utjecale na njihovu subjektivnu kvalitetu iskustva ni u jednom od okruženja za učenje. Rezultati ukazuju na sličnosti u iskustvu učenika, bez obzira na njihovu dob i razred osnovne škole u koji se uvode tradicionalne igre. To je velika prednost jer sugerira da se slični pristupi mogu primijeniti u svim razredima.

Ovdje predstavljeno istraživanje također nudi empirijske dokaze da olakšano korištenje utječe na motivaciju i stavove učenika za vrijeme novih nastavnih praksi. Stoga važnost interakcije na relaciji nastavnik – učenik (koja naglašava važnost kompetencija nastavnika) i odgovarajuće prezentacije sadržaja (Malinovski i sur., 2014; Ward, Peters, i Shelley, 2010) putem odabrane igre predstavljaju značajne čimbenike u sličnim okruženjima za učenje, iako ne stoje u izravnoj vezi s iskustvom učenika, osim u sinkronom okruženju. Osim toga, na stavove učenika prema svakoj od tri nastavne prakse također utječe motivacija učenika na sudjelovanje, što komplicira slične postojeće modele prihvaćanja tehnologije (iako im ne proturječi; Davis, 1993; Lee, Cheung, i Chen, 2005; Liu i sur., 2010; Yusoff, Crowder, i Gilbert, 2010), orijentirane na primjenu tehnologije.

Posljedica toga je da rezultati ovdje predstavljenog istraživanja pokazuju kako okruženje za učenje zasnovano isključivo na igri dovodi do više razine iskustva učenika i ishoda učenja u usporedbi s okruženjima kojima je pridodan neki oblik aktivnosti učenja na daljinu. Stoga je nužno uložiti dodatni napor kako bi se unaprijedila motivacija učenika da pohađaju slične sate, te ponudila odgovarajuća tehnička podrška i kvaliteta na satima na kojima se prednost daje metodama učenja na daljinu. Imajući na umu činjenicu da stavovi učenika i njihov subjektivni doživljaj kovariraju s njihovim rezultatima, odgovarajući pristup orijentiran na učenike koji uvećava pozitivnu razinu kvalitete iskustva učenika važan je korak prema uvećanju krajnjih rezultata učenja.

Zaključak

Zahvaljujući njihovu obrazovnom potencijalu, igrama se moguće koristiti kao obrazovnim dodatkom različitim obrazovnim kontekstima ili ih se pak može u potpunosti inkorporirati u obrazovno okruženje. Budući da je za vrijeme učenja zasnovanog na igri važno razumjeti učenike, ovdje predstavljeno istraživanje temelji se na pristupu orijentiranom na učenika te analizira širok raspon čimbenika koji utječu na iskustvo učenika za vrijeme integracije tradicionalnih igara izvođenih u učionici u osnovnoškolski program. Predstavili smo važne varijable s pomoću kojih je na odgovarajući način moguće predvidjeti razinu pozitivne kvalitete iskustva učenika te

ponudili model koji ilustrira uzročnu vezu između latentnih konstrukata u različitim uvjetima učenja. Ti rezultati pokazuju da je s pomoću odabranih čimbenika moguće objasniti više od 90% varijance kvalitete iskustva učenika u bilo kojoj situaciji, koja se odražava putem zadovoljstva učenika, zabave pridružene učenju, kao i uvjerenja učenika vezanih uz uvećanu učinkovitost i produktivnost.

U našem smo se istraživanju koristili tradicionalnim dječjim igrama u okruženju učionice te potaknuli učenike osnovne škole da među članovima vlastitih obitelji provedu anketu o igrama iz njihove regije te na taj način očuvaju kulturnu baštinu. Iako učenje na daljinu nije raširenо u programima osnovnih škola, istražili smo mogućnost dodavanja pojedinih aktivnosti učenja na daljinu procesu učenja zasnovanog na igri, sa svrhom njegova poboljšanja. Učenicima smo stoga unaprijed dostavili materijale za učenje. Na taj im je način omogućeno da budu još fleksibilniji pri organizaciji vlastitih aktivnosti učenja (asinkrono učenje). S druge strane, stvorili smo suradničko okruženje za učenje izgrađeno oko videokonferencije uključene u aktivnosti zasnovane na igri koje su provođene u dvije međusobno udaljene škole. Pritom smo uspoređivali uvjete učenja zasnovanog na igri u učionici, kao i uvjete (a)sinkronog učenja. Model istraživanja testiran je s pomoću odgovora učenika prikupljenih anketama provođenim nakon svakog sata, što je dovelo do odgovarajućeg slaganja modela utemeljenog na strukturnom modeliranju. Kao što smo pokazali, tim je modelom moguće predvidjeti ponašanje i kvalitetu iskustva učenika osnovnih škola. Iznoseći znanstvene dokaze o čimbenicima kojima je moguće predvidjeti iskustvo učenika u situaciji kada se obrazovne igre uvode u učionicu, ovo istraživanje može pomoći administratorima škola i nastavnicima.

Također smo ocijenili rezultate učenika u kontekstu tri različite nastavne prakse na polju interesa, interaktivnosti i ocjena, koji koreliraju s njihovom kvalitetom iskustva. Iako je usporedba rezultata učenja za vrijeme različitih uvjeta učenja bila kratka i informativna, buduće analize mogu se koristiti predloženim modelom kvalitete iskustva i potvrđenim mjerama u ocjenama dodatnih čimbenika kao što su postojeće znanje, kognitivne sposobnosti učenika, osobni stil učenja i sl., sa svrhom opisivanja detaljne korelacije između kvalitete iskustva i rezultata učenja u sličnim okruženjima.