

The Educational Prospects of Traditional Games as Learning Activities of Modern Students

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Abstract. “Grandma’s games” is an educational case study that introduced few selected traditional games into the regular education of K9 students, attempting to bring together the benefits of traditional outdoor games that our ancestors used to play and the modern technology that is closer to the present generations. The objectives of this project target the educational outcomes while having a strong consideration of the social and emotional aspects of students regarding motivation, joy, positive upbringing patterns and connection to the traditional values expressed in our folklore.

We selected six traditional games and introduced three couples of them into the regular curricula of Math, Art and Nature/Society in few sixth grade classes. Each game was carefully selected aiming to improve certain aspect of the learning process with regard to the individual differences in personality, learning style and ability of each student.

The games “Hop-scotch” and “Match Box” selected for Math classes were aiming to improve the student’s logical reasoning, expressive skills were enhanced with the aid of “Lady” and “String” games on Art classes, and social skills were developed during the “Mosque” and “Hide and Seek” games on Nature/Society classes. The instructional design for this case study expressed in the teacher’s manual included lesson plan, objectives to be accomplished, detailed description of the game to be used to accomplish certain objective, description of the roles of the teacher and the students, teacher’s guidance to the learners, the expected feedback from the students, and instructions for performance assessment. The game based learning scenario encouraged active participation of all the students in the games, collaboration, and cooperative work on problem solving tasks given during and after the games, active participation of the students in the evaluation process, development of critical thinking, and praising the friendship during the joyful learning activities.

While games were played in classical face to face manner, the use of technology was encouraged during the problem solving sessions, collaborative videoconferencing sessions with the peers from the other schools, and to facilitate communication with the peers from the distant parts of the country with aid of social networks.

The effects of the selected games on educational outcomes were investigated using multiple criteria including evaluation of the academic performance and overall estimation of the transferable skills as communication, collaboration and interactivity. Our findings suggest that different games impact the learner’s satisfaction, which in turn has significant impact on educational outcomes. The correlation between individual factors (personality; learning style) and experienced satisfaction with different games during the study reveals the importance of personalized approach in education for optimal learning results.

Keywords: educational games, pedagogy, personality, learning style

1 Introduction

Motivation of students has been recognized as a leading factor that determines student’s engagement with the educational process. The engagement and persistence in learning are further determinants of the educational outcomes to be achieved. A motivated learner is focused and self-determined on the educational activity without additional stimuli needed to retain his attention. Therefore providing a model that would properly address the learner’s motivation is a challenging issue of instructional design. The approaches to motivation can be either intrinsically or extrinsically driven. Some intrinsically based approaches recognize challenge, fantasy, and curiosity as main categories affecting the student’s motivation (Malone, 1980; Malone, 1981). The extrinsic

approaches find the desired outcome as the main factor that motivates the learner to get engaged in certain learning activity (Garris, Ahlers, & Driskell, 2002).

The games are fun activities consisting in their essence the main intrinsically motivating factors that captivate learner's attention and make him persistent and enthusiastic about the activity. Therefore the games are recognized as a valuable tool in instructional designs that strive to create learning environments that are both interesting and educative. Besides making the learning fun, games are perceived as valuable tool in "learning by doing" paradigm described by Schank as: "There is only one effective way to teach someone how to do anything and that is to let them do it" (Schank, Berman & Macpherson, 1999).

Looking for a way to embrace the motivating force of social games we came to an idea to bring the traditional outdoor games that our ancestors used to play into the educational process of our present students. Introduction of traditional games into the learning activities enhances motivation in all the components of instructional design promoting:

- Attention by ensuring active participation of all the students in the game based learning activities
- Relevance by utilizing familiar playing activities to achieve the newly set up learning goals
- Confidence by providing a relaxed environment in which students have control over the actions needed to achieve the objective
- Satisfaction, which is an intrinsic attribute of the games offering positive feelings of equity, unity, vividness, fairness, that can be effectively used during the learning activities

We strive not only to increase the motivation of the students through joyful learning activities, but also to bring positive social development patterns reflected in direct communication with the peers, cooperation in accomplishing tasks in real time, healthy psychophysical development by practicing outdoor activities, commitment to the folklore roots and traditional wisdom of our culture, promoting multicultural and multiethnic values by getting to know the tradition of the other coexisting cultures, etc.

The students were actively involved not only in the learning activities but also in the creation of the learning scenario from the very beginning of the idea throughout its realization. The process of game selection begun by investigating and collecting the games that student's grandparents used to play. For that purpose the students conducted a research activity that involved a visit to their grandparents or other seniors, finding out the games they used to play in childhood, writing a short essay about the game, and giving ideas of possible application in the learning activities of regular curricula. After the ending of the collection process, a discussion on the games was held, upon which a selection of six traditional games to be used in the study was made. The selected games were compiled in an instructional manual with detailed description of each game, its application for learning activities and objectives to be achieved. The educational project that came out from these activities was entitled "Grandma's games".

Following we will give a short literature review on the games in education, a short description of the games and the activities conducted during the study, evaluation of results from the targeted learning outcomes, and in the end we will give some brief conclusions on prospect and possible future applications of traditional games in education.

2 Literature review

The concept of "discovery learning" claiming that children learn best through doing and actively exploring was given in the Piaget's theory of cognitive development. (Piaget, 1952) The idea emerged into a branch of educational philosophy known as constructivism that places the learner into in the center of educational process by promoting knowledge acquirement through active direct experience, rather than learning through repetition and positive reinforcement as given in the behaviorist theory (Duit & Treagust, 1998; Steffe & Gale, 1995). The idea made a great impact on development of educational approaches that recognized the games as a great educational tool that promotes development of problem-solving skills, creativity and originality through active discovery, collaborative and task oriented learning (Driscoll, 2000).

In addition to the constructivist educational pillars, the Vygotsky's sociocultural theory recognizes play as a method that doesn't just make learners to acquire new knowledge but to support their personal development. According to Vygotsky, the children's greatest development is accomplished through make-believe play by

creating imaginary situations in which children are encouraged to take various roles in different scenarios, with regard to the rules that govern the relationships between the specific roles (Vygotsky, 1980).

Game Based Learning (GBL) emerged from the idea to involve computer games in education aiming to enhance the learning process by offering a funny and familiar media that captures and retains the student attention and interest in subject (Prensky 2005). Educational games need to be designed to balance between educational quality of the learning subject and the game, regarding the ability of the gamer to apply and retain the adopted knowledge in the real world (Pivec, Dziabenko & Schinnerl, 2003). The games often contain elements of fantasy engaging the gamers to learn through stories (Juul, 2011:121). Educational computer games can be a motivating force and foster development processes in the child consciousness. The success of the strategy games is due to the active involvement and interaction of the gamer, crucial for gaining experience (Amory, Naicker, Vincent & Adams, 1999).

Game based learning scenarios engage learners into interactive, problem based situations that encourage critical thinking, communication and collaboration as well as flexibility and adaptability for functional knowledge acquisition. These qualities are completely in line with the 21st century skills, identified as: Learning and Innovation, Digital Literacy and Career and Life skills (Trilling & Fadel, 2009:45).

Taxonomy of the theories, methods, qualitative and quantitative analysis of the games used for educational purposes is given in (Ke, 2009). The research gives a meta-analysis resulting from comparative analysis of 89 educational games, concluding that GBL has great potential to enhance the learning and motivational qualities of the students. The study suggests that the real challenges of learning through game emerge when the content and the skills adopted through the game should be reused outside the gaming context and environment.

In our game based learning approach, we tend to bring together traditional games and modern technology in education, creating motivating and joyful learning activities that address learning outcomes while fostering folklore values of our tradition.

3 Research design

The instructional design for this study followed the ADDIE model (Molenda, 2003), that stands for Analyze, Design, Develop, Implement, and Evaluate. The first stage started with analysis of the educational prospects of each collected game, analysis of most suitable age to implement the games, and analysis of the possible subjects and thematic units from the national curriculum whose learning objectives can be implemented with particular game. At the end of this stage we decided to introduce “Match Box” and “Hop-scotch” on Math classes, “Lady” and “String” games on Art classes, “Mosque” and “Hide and Seek” games on Nature/Society classes.

In the design stage, the learning objectives to be achieved for each unit were identified. The thematic units from the national curriculum, the games as learning activities, and the methods to achieve the targeted learning objectives were connected. The teacher’s guidance, roles of the teacher and the students, instructions for the technology to be used during the classes, tasks and forms to accomplish the tasks, organization of the discussions and presentations were specified in the development phase.

The “Grandma’s games” were implemented by eighth teachers on 142 sixth grade students in five primary schools in the Republic of Macedonia. 77 of the students were male, and 65 were female. Three schools were from rural and two from non-rural areas of the country. The study started at the beginning of the summer semi semester having each game played on at least three classes to cover the selected thematic unit. After conclusion of each thematic unit, evaluation was conducted.

The evaluation of the educational prospects of the traditional games used in this study involved two criteria: evaluation of the academic performance of the students and overall estimation of the transferable skills as communication, collaboration and interactivity.

The thematic units for each subject where the game was applied, the learning objectives that were targeted, and a brief description of each game as learning activity, as well as the computer technology used to complement the traditional games as learning activities are given hereinafter.

3.1 “Matchbox” and “Hop-scotch”

Subject: Math

Thematic unit: Integer arithmetic operations (addition and subtraction); Geometry: shapes and perimeter

Learning objectives: logical reasoning, developing 21st century skills

Matchbox description: An empty matchbox is written numbers on each side of the box. The box is set on an edge of a table, one half laying on the table and the other half out of the table. The player hits the outer half of the matchbox with his thumb. The matchbox flies up in the air and then falls on the table. The number on the upper side is added to the total score for the player in one round and extracted from total score in the next round. The game is played in fixed number of rounds (usually five). The goal of the game is to obtain a total score equal or closest to a target number given at the beginning of the game.

Matchbox as learning activity: During the game the students are to consider which number should hit in the current round to bring them as close as possible to the target. This way they develop reasoning, memorizing and predicting different possibilities depending on the game outcomes. The game was designed with different difficulty levels, depending on the numbers written on the box (one, two or more digits), the operations in each round (addition, subtraction or mixed), and the number of rounds. The appropriate level is chosen according to the age of the students.

Hop-scotch description: A geometric shape divided in fields is drawn on a playground. Fields are marked with numbers. A player needs a flat round stone to throw it inside a marked field. If player successfully finishes the game in the current round, the number from the field where his stone has fallen is added to his score. The goal of the game is to obtain a total score equal or closest to a target number given at the beginning of the game. The number of rounds to play is given at the beginning of the game. The player is jumping on one foot from one field to another beginning from the field marked with lowest to the highest mark and back to the field where his stone has fallen. The basic rule of the game is that a player is not allowed to step on a line, nor the stone should fall on a line. If the player steps on a line while jumping or throws the stone on a line, then he exits the game in current round and no number is added to his score.

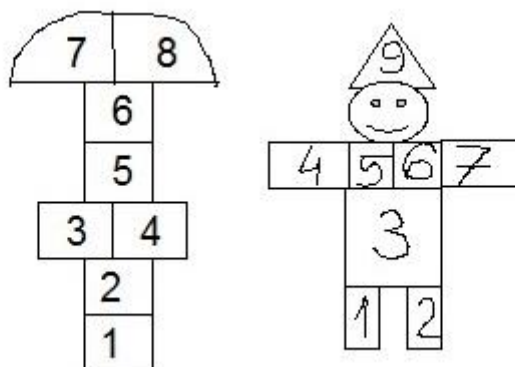


Figure 1: Examples of scheme designs for “Hop-scotch”

Hop-scotch as learning activity: Besides developing the logical reasoning by considering the number that gets them closer to the target as in the Matchbox game, the Hop-scotch was used on the geometry classes as well. The students draw a playground scheme from a given set of geometric shapes, and then calculate the perimeter of the resulting figure. Having in mind that students of age 9-10 are in the concrete operational stage of their cognitive development (Ginsburg & Oppen, 1988:152), the actual drawing of geometric shapes in different contexts helped them develop their inductive reasoning and the ability to classify shapes depending on the angles, sides and dimensions.

Technology: The spreadsheet applications were used to create lists and calculate scores of the players during the games. Graphical tools were used to draw scheme designs for Hop-scotch on a computer.

3.2 “Lady” and “String”

Subject: Art

Thematic unit: Modeling patterns and creating shapes

Learning objective: visualization, expressive skills, symmetry in space

Lady description: A scheme of spots is drawn on a paper, as given in Figure 2. The goal of the game is to create a “lady” (checkers), by sorting three pebbles in a horizontal or vertical position as indicated on the scheme. The game needs two players each of them having nine pebbles at the beginning of the game marked as either red or black. The player who succeeds to create “lady” has the right to take one of the opponent’s pebbles. The player who remains with only three pebbles can move them freely on every spot available in order to stop the opponent to create “lady”. The winner is the player who succeeds to take seven of the opponent’s pebbles.

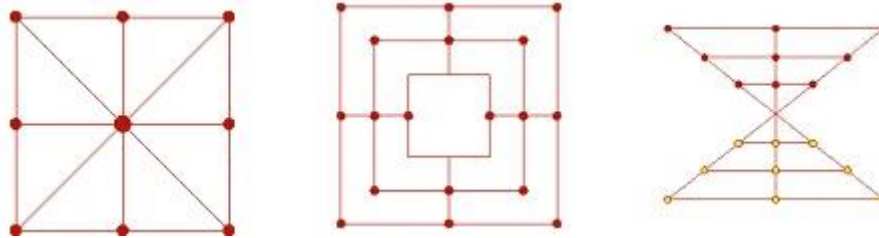


Figure 2: Examples of scheme models for “Lady”

Lady as learning activity: The students were to create different scheme designs for the game with various materials: paper, dough and clay. The students were able to get acquainted with the different properties of the materials, to visualize the symmetry of different shapes, to improvise different designs and patterns inspired from our folklore.

String description: The needed material for this game is a hemp thread or other string with a length of approximately 60cm. The string ends are tied in a knot, allowing the player to create different shapes by twisting and turning the string around his fingers. The game can be played by one or more players, depending on the shape that is to be made. There are many shapes that can be created in this manner, some shapes can be presented by the teacher and some can be let to the student imagination.

String as learning activity: During the game, the students were able to manually create different shapes, get acquainted to the concepts of symmetry, parallel lines, dimensions in space, projection of the three dimensional objects in two dimensions.

Technology: Graphical tools were used to draw scheme designs on a computer.

3.3 “Mosque” and “Hide and seek”

Thematic unit: Interpersonal relationships

Learning objective: social skills, collaboration in a team to achieve common task, multicultural values, tolerance

Mosque description: A square with approximately 1m sides is drawn on a flat surface. In the center of the square a small circle is drawn. Five flat round stones are placed in the center of the circle one over the other forming a stack. The participants are divided in two teams with up to ten members each. The players from one team are trying to ruin the stack of stones by rolling a ball towards the stack from the 2-3m distance from the center of the stack. Once the stack is ruined in pieces, the team has to rebuild the stack by putting the stones back to the stack. The members from the opposite team try to prevent the players to rebuild the stack by hitting them with the ball. Once a player is hit with the ball, he has to leave the game. The team that manages to rebuild the stack in the scheduled time wins the game.

Mosque as learning activity: During the game the players were able to feel and express different emotions ranging from positive such as: pleasure, vigorousness, unity; to negative emotions as: anger, conflict, unfairness, discomfort, etc. The discussions and workshops held after the game helped the students to better understand the individual differences, different mindsets, to cope with their negative emotions, to resolve conflicts, develop empathy, friendship, trust etc.

Hide and seek description: The game we used in our study is a variation of the well-known children’s game “Hide and Seek”. In this game, one player is in the center of a circle formed by the rest of the players holding their hands. The player in the center has his eyes covered with a ribbon, and the rest of the players dressed with different pieces of folklore clothing are singing and dancing around him. Eventually players stop moving and

singing on a given mark. The player with covered eyes moves towards a random player from the circle, and tries to guess who he is by using his senses of touch and smell.

“Hide and seek” as learning activity: During the game the students were introduced into situations that helped them recognize the similarities and differences in individuals coming from different cultures. The discussions and workshops held afterwards helped the students to get familiar with the different traditions and cultures in our country, to express their opinion, to cherish the friendship regardless of the cultural differences, to respect the multicultural values.

Technology: Videoconferencing sessions were organized with peers from the other schools to discuss the insights during the games, exchange experiences, and get familiar with the peculiarities of the people living in different parts of the country.

4 Evaluation of the effects of the games as learning activities

To evaluate the effect of the games involved in our study, we compared the mean grade difference of 142 students involved in the study (group A) from the beginning to the end of the study, with the mean grade difference of another 126 students (group B) that did not participated in our game based learning study. The group A was formed from eight classes of 6th grade students that learnt following the GBL scenario. The other group consisted of another eight classes of 6th graders from the same schools, receiving instructions in regular manner by other teachers that were not involved in the GBL study. The grades range from 1 to 5, where 1 is the lowest and 5 the highest grade. The summary of the comparison is given in Table 1.

Table 1: Summary of the means comparison for the groups A and B

	Math				Art				Nature/Society				
	Semi semester grade	End of study grade	Abs diff.	% inc.	Semi semester grade	End of study grade	Abs diff.	% inc.	Semi semester grade	End of study grade	Abs diff.	% inc.	
A	Mean	3.97	4.46	0.49	12.34	4.19	4.55	0.36	8.59	4.11	4.45	0.34	8.27
	Std. Dev.	1.123	0.847			1.078	0.777			1.171	0.872		
B	Mean	4.47	4.80	0.33	7.38	4.32	4.75	0.43	9.95	4.33	4.57	0.24	5.54
	Std. Dev.	0.712	0.474			0.855	0.565			0.856	0.709		

We used Mann Whitney U test (confidence level 95%, alpha=0.05), to test whether the difference in performance between two groups is statistically significant. The test revealed that the difference in academic performance is statistically significant for Math classes (P=0.03) and Nature/Society classes (P=0.037), and is not statistically significant for Art classes (P=0.665). The result indicates that the grades development of students in group A on the Math and Nature/Society classes, might have been influenced by the introduction of the GBL scenario on classes. However, this result needs to be further confirmed on a broader sample and considering the other factors that might influence the result.

The teacher’s perception of the student communication, collaboration, and interactivity expressed as transferable skill (Trilling & Fadel, 2009:54) was rated with 1 to 5 score by the teacher. Additionally students have expressed satisfaction i.e. their personal feeling of enjoyment with each game as learning activity, by scoring the game on a five-point Likert scale (1 for the lowest and 5 for the highest satisfaction).

We performed a Kruskal Wallis test (confidence level 95%, alpha=0.05), to test whether there is a statistically significant difference in student’s satisfaction depending on the type of games used as learning activities. The test revealed that there is a statistically significant difference in satisfaction depending on game type (chi-square=25.837, p=0.000). To find where the difference appears, we performed additional Kruskal Wallis tests on the pairs of the three types of games, and revealed that the difference in satisfaction is significant between logical and social games used on Math and Nature/Society classes respectively (chi-square=6.451, P=0.011) and between logical and expressive games used on Math and Art classes respectively (chi-square=11.496, P=0.001). The difference in satisfaction was not significant between expressive and social games used on Art and

Nature/Society classes respectively ($\chi^2=0.775$, $P=0.379$). The students expressed highest mean satisfaction with the expressive games, and lowest with the logical games.

Having in mind the individual differences in personality and learning style of students, we have explored if the effect of the games on satisfaction is influenced by the learning preferences of the students. The learning preferences of each participant in the study were evaluated using VARK questionnaire for young people (Fleming, 2006) completed by each student at the beginning of our study. The VARK model of learning styles classifies the learners according to their instructional preferences for giving and receiving information as Visual, Aural, Read/Write and Kinesthetic as basic modalities of learning styles. Besides single modality learners that show strong inclination towards particular learning style, the VARK methodology recognizes bi/three/multimodal learners that benefit from multiple learning styles, as given in Table 2.

Table 2: Learning style preferences according to VARK methodology

Learning style Preference	Profile
V	Visual (Very Strong , Strong, Mild)
A	Aural (Very Strong , Strong, Mild)
R	Read/Write (Very Strong , Strong, Mild)
K	Kinesthetic (Very Strong , Strong, Mild)
Bimodal	VA, VR, VK, AR, AK, RK
Three modal	VAR, VAK, ARK, VRK
Multimodal	VARK

We performed two-way ANOVA tests ($\alpha=0.05$) having the game type and learning style as independent variables and satisfaction as dependent variable. We obtained no statistically significant effect of the game type on satisfaction for Visual learning preference ($F=0.275$, $df=10$, $P=0.993$), Aural learning preference ($F=0.542$, $df=12$, $P=0.861$) and Read/Write learning preference ($F=1.537$, $df=12$, $P=0.861$). But the effect was significant for Kinesthetic learning preference ($F=1.917$, $df=12$, $P=0.029$). Kinesthetic learners showed stronger preference for social and expressive games, and weaker preference for logical games.

The results of our study indicate that individual learning preferences of students affect the student's experience during the game based learning activities. Having in mind that the learners experience during the games clearly affects the learning results, the estimation of the learning style of the students should be considered as an indicator of the types of games and learning activities to be included in the game selection process.

5 Conclusion

Present generations of students are highly influenced and attracted by the modern technology devices, spending significant amount of time interacting with devices rather than their peers. The technology plays a substantial role in their lives affecting the fields of education, entertainment, social life, interpersonal relationships etc. The traditional face to face games seems to be pushed aside, and gradually replaced by the computer games. Although the application of computer games in modern learning setups seems to be beneficial to the present students, our vision is that traditional outdoor games can offer complementary learning activities that can produce positive outcomes not only regarding the educational objectives, but also to the physical and emotional development of the young generations.

Our approach tends to exploit the motivating force of the games in education, but in the same time to pay attention to the positive effects of traditional games as engaging activities used in the actual learning process. Our findings reveal that student's satisfaction varies depending on the different types of games used in the GBL activities, as well as the learning preferences. The teachers involved in the study found that they can use the games as an auxiliary tool to bring some abstract concepts closer to the concrete operational mind of young students, such as projection of three dimensional objects in less dimensions while playing the String game, multicultural values and democracy while playing the Mosque game and etc.

Our study suggests that the individual differences expressed as different learning styles influence the learner's perception of the learning activity and therefore should be considered during the design phase of the game based learning scenarios. The future work should explore in more details the relationship between individual traits and the preferences for different gaming setups, and to offer adaptable learning scenarios that can be personalized in order to boost the learner's potential.

Acknowledgments

We would like to express gratitude to the work of teachers Tinka Bedzovska, Vesela Bogdanovik, Cvetanka Karovska, Maja Kitanoska, Nada Krsteva, Olivera Palifrova, Mica Miteva and Daniela Krstevska who practically implemented the ideas presented in this work.

References

- Amory, A., Naicker, K., Vincent, J., & Adams, C. (1999). The use of computer games as an educational tool: identification of appropriate game types and game elements. *British Journal of Educational Technology*, 30(4), 311-321.
- Duit, R. & Treagust, D. (1998). *Learning in science - From behaviourism towards social constructivism and beyond*. In B. Fraser & K. Tobin, Eds., *International handbook of science education* (pp. 3-26). Dordrecht, The Netherlands: Kluwer Academic Publishers.
- Driscoll, M. (2000). *Psychology of Learning for Instruction*. Needham Heights, MA, Allyn & Bacon.
- Fleming, N. D. (2006). *Teaching and learning styles: VARK strategies*. ND Fleming.
- Garris, R., Ahlers, R., & Driskell, J. E. (2002). *Games, motivation, and learning: A research and practice model*. *Simulation & gaming*, 33(4), 441-467.
- Ginsburg, H. P., & Opper, S. (1988). *Piaget's theory of intellectual development*. Prentice-Hall, Inc.
- Juul, J. (2011). *Half-real: Video games between real rules and fictional worlds*. MIT press.
- Ke, F. (2009). A qualitative meta-analysis of computer games as learning tools. *Handbook of research on effective electronic gaming in education*, 1, 1-32.
- Malone, T. W. (1980). *What makes things fun to learn? A study of intrinsically motivating computer games* (Doctoral dissertation, ProQuest Information & Learning).
- Malone, T. W. (1981). Toward a theory of intrinsically motivating instruction*. *Cognitive science*, 5(4), 333-369.
- Molenda, M. (2003). In search of the elusive ADDIE model. *Performance improvement*, 42(5), 34-37.
- Piaget, J. (1952). Play, dreams and imitation in childhood. *Journal of Consulting Psychology*, 16(5), 413-414.
- Pivec, M., Dziabenko, O., & Schinnerl, I. (2003, July). Aspects of game-based learning. In *3rd International Conference on Knowledge Management, Graz, Austria* (pp. 216-225).
- Prensky, M. (2005). Computer games and learning: Digital game-based learning. *Handbook of computer game studies*, 18, 97-122.
- Schank, R. C., Berman, T. R. & Macperson, K. A. (1999). Learning by doing. In C. M. Reigeluth (Ed.), *Instructional Design Theories and Models: A New Paradigm of Instructional Theory* (Vol. II) (pp. 161-181). Mahwah, NJ: Lawrence Erlbaum Associates.
- Steffe, L. P., & Gale, J. E. (Eds.). (1995). *Constructivism in education* (p. 159). Hillsdale, NJ: Lawrence Erlbaum.
- Trilling, B., & Fadel, C. (2009). *21st century skills: Learning for life in our times*. John Wiley & Sons.
- Vallerand, R. J., Fortier, M. S., & Guay, F. (1997). Self-determination and persistence in a real-life setting: toward a motivational model of high school dropout. *Journal of Personality and Social psychology*, 72(5), 1161.

Vygotsky, L. S. (1980). *Mind in society: The development of higher psychological processes*. Harvard university press.