

Student Response to Educational Games – An Empirical Study

Urszula Świerczyńska-Kaczor
Jan Kochanowski University
in Kielce, Żeromskiego 5,
25-369 Kielce, Poland
Email: swierczynska@ujk.edu.pl

Jacek Wachowicz
Gdańsk University of Technology
ul. G. Narutowicza 11/12,
80-233 Gdańsk, Poland
Email: jacek.wachowicz@zie.pg.gda.pl

Abstract—In this article we explore students' experience with digital educational games. We analyze and discuss the factors which determine a student's perception of the educational benefits of game-based learning. The organization of the research is structured by the main question - how do variables such as player satisfaction, game features (e.g. the perceived quality of the educational content, the design) and enhancement in the player's educational process are interconnected. The study proves that games as an educational tool are assessed very favorably by undergraduate students of business and economics. Moreover game features are correlated with educational benefits and player satisfaction. A player satisfaction is also linked with enhanced learning.

I. INTRODUCTION

SERIOUS games – intended to improve players' learning skills – are regarded to be a more effective educational tool than traditional lectures when it comes to meeting the needs of the 'digital millennium generation'. The 'virtual generation' ('digital natives') learns differently compared to previous less technologically immersed generations (Pasin & Giroux 2011), although it is arguable that 'differently' means 'better'.

The number of publications referring to digital game-based learning has significantly increased in the first decade of the 21-st century (Hwang & Wu 2012). Nowadays the body of literature empirically or theoretically embracing the problems and issues connected with game-based learning is quite significant. Publications which clearly show the direct comparison between the different studies (the aims, participants, main findings), such as Pasin & Giroux (2011) or Wu et al. (2012), are particularly insightful and useful for understanding the scope of research that has been conducted in this field.

Therefore, due to the wide variety of forms (strategic games, solitary games, social games, board games, computer games etc.) the conclusions from different studies about the educational effectiveness of the game are not easily comparable. Most studies argue for the educational effectiveness of games, although different authors set different approaches for conducting their studies. For example Tao et al. (2009) proposed a model developed from the technology accep-

tance model, the expectation confirmation theory, and the agency theory. Other authors, Lin & Tu (2012) implemented the concept of means-end chain (MEC) to explore the value sought by players. Also in the literature researchers refer to different learning theories (behaviorism, cognitivism, humanism, constructivism) or they do not refer to any theory of learning at all (see – Wu et al 2012). Analysis of game-based learning is even more difficult due to the lack of a clear definition of game features. Games have game mechanics (which includes such elements as points or virtual gifts), game dynamics (e.g. status, reward, individual achievement and self-expression), an immersive environment which includes the rules, the story which outline the theme of the game, the embedded risks and competition (Derryberry 2007, Simões et al. 2013). A game's interactivity, which is the imminent aspect of a digital game (Rouse III 2005) is also difficult to assess and define. (Even as a website feature is difficult to measure due to the incongruence in the actual and the perceived interactivity of the website – Voorveld et al. 2011).

The study presented in this article is an exploratory study. So far business simulation games are not very popular in higher education in Poland and this presumption was confirmed by the empirical study presented below – only three participants of over 100 reported previous game-related experience. Do students perceive games as useful tools in formal education? Do educational games in higher education meet academic standards from the students' point of view? Although we would point out that we do not focus on answering the question whether or not a university's educational program can be substantially based on games, or if the games can replace the academic reading, class discussion and live lectures. We rather see that games can be useful tools for the purpose of introduction and invitation to more in-depth analysis.

II. RESEARCH DESIGN

This article presents part of data and analysis conducted as part of a wider research project "e-Education within the social Internet". In the part of the project presented here two simulation games - Trade Ruler Game and Marketing Manager (connected with economic and managerial problems) - were tested for their educational benefits (see Table I).

¹This work was a part of the project 'Badanie statutowe 614564' Jan Kochanowski University in Kielce

We understand simulation games as to be games which have an embedded risk of losing or winning, are based on a backstory, and have game mechanics; on the other hand, they embed simulation (see Tao et al. 2012) One of the selected games – Marketing Manger – can be classified as a functional game around the specific topic of business. The other – Trade Ruler Game – can be classified as concept simulation in referring to a specific type of decision making (classification of the management simulation games - Pasin & Giroux 2011). We used games which are not time-consuming and can be completed within one-hour of play. This kind of game increases participants’ full attention and motivation for the whole duration of the study. (Very complex games, such as multi-module business simulation games, need much more time and effort to play and therefore bring different challenges for educators).

In the present study we measured the constructs – the navigation of the game, the design, the educational content – as the player’s perception-based construct. This means that the participants of the survey answered questions about their feelings and perceptions (e.g. they agree or disagree with the statement “I can easily find information which I need”). Most students played the games as an out of class task and then they filled out the questionnaires. We did not measure the progress which students made playing the games several times – instead we asked them to generally assess their feelings about using this new form of learning. We also did not include in the study data referring to the heterogeneity of the participants such as risk avoidance, general attitude to the university or interest in their studies.

We chose the constructs to measure arbitrarily, agreeing that they are under theorized and often have different meaning in the literature (with the concept of design as a prime example). In this study we wanted to ‘capture’ the students’ general feelings and experience regarding game-based education.

In this empirical study we assumed that the game features – the educational content, the ease of navigation and the design of the game - influence player satisfaction and that satisfaction is linked to the player’s enhanced learning (Fig. 1). Therefore the hypotheses are:

H1: The game features - the perceived value of the educational content, the perceived design of the game, and the ease of navigation and playing - enhance player satisfaction

H2: The features of a game and a player satisfaction are linked with the player’s educational benefits.

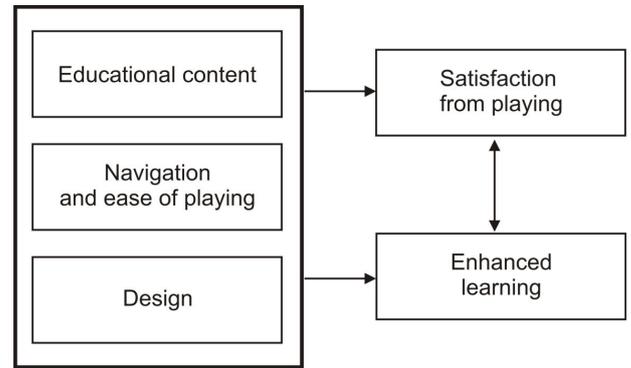


Fig. 1 The framework for empirical research

For this research, a questionnaire was developed to gain students’ feedback (see Table II–VIII). The study was conducted in April 2013. A total of 208 filled questionnaires were received, 99% of the respondents were under the age of 25. All of the participants are business and economics students at one of three different Polish universities. In the study:

- for the Trade Ruler Game 106 participants took part - 72% of which were women,
- for the game Marketing Manager – 102 participants took part with the same proportion of women – 72%.

Very few – only three participants stated that they had previous experience with the game-based learning connected with economics or management.

III. RESULTS AND DISCUSSION

Tables II-VIII present the main results and the structure of the survey questionnaire. Summarizing the results we can point out that:

1. The students’ perception of the game Trade Ruler is affected by the language of the game which is not

TABLE I.
CHARACTERISTICS OF THE GAMES

<p>Trade Ruler Game – available: http://www.nobelprize.org/educational/economics/trade/index.html</p>	<p>This is an educational game available at Nobel Prize official website. The theme of the game is based on the Heckscher-Ohlin trade theory. The player takes the role of the leader of one country and has to make decisions - depending on the country’s resources– regarding production and trading with another country. After a few turns the player receives information about the score - calculated on the basis of the welfare of the country as a result of international trading. The language of the game - English</p>
<p>Game Marketing Manager http://www.nbportal.pl/pl/cw/gry/gry_deczyjne/marketing</p>	<p>The game is available at the educational website of the National Bank of Poland. The task of the player is to choose marketing options for a car company: to decide to buy or not to buy a market research report, choose the client base, establish a delivery chain, etc. The player receives information on how the decisions affect the company’s finances in areas such as sales, profits, and costs. A player’s score is based on the total number of points given for the correctness of the player’s business decisions. The language of the game - Polish</p>

- their native language. Almost 40% of the students stated that the game's language was a problem or a significant problem (table II).
- Students assessed the educational content of the analyzed games very favorably (table III). The majority (over 80%) of the participants claimed that The Trade Ruler Game or Marketing Manager Game helped them to better understand the economic issue in focus (the trading between different countries or basic marketing strategic options).
 - The games analyzed were perceived by the players to be easy to navigate and easy to find the necessary information (table IV). In both games over 90% of the participants found the game easy to play, over 80% found information easily and the majority of the players found their score without problems
 - The design for both games was also well received (table IV). Interactivity was positively assessed by over 80% of informants in both games, graphic design over 55%, with the general quality of The Trade Ruler Game received an average score of 2.8

- (on a scale of 1-4) and Marketing Manager Game-3.1.
- Player satisfaction is high for both games (table VI). The majority – nearly 80% of players ranked their satisfaction at a 3 or 4 in Trade Ruler game (the average being 3.0). In the case of Marketing Manager the percentage was 90% (the average being 3.3).
 - Players perceived the games to be very useful and effective educational tools (table VII). They claimed that the games triggered their interest in economical or marketing issues (over 80% of participants), made learning more effective (over 85% of participants), helped to increased engagement in the subject (over 80%) and linked the learning process to a positive emotion (over 85% of participants).

In order to test the hypotheses we looked for correlation between variables (table VIII) and a weak or moderately positive correlation between some of the variables were found. Below we emphasizes the findings for the moderate positive correlation (R Spearman above 0.33, p<0.05).

TABLE II.
THE PLAYERS' ASSESSMENT OF HOW LANGUAGE AFFECTS PLAYING THE GAME

How much of a problem was the use of the English language in "The Trade Ruler" game in your playing of the game?	Not a problem at all	It was a problem	It was a significant problem
N=106	61%	30%	9%

TABLE III.
EDUCATIONAL CONTENT [TRADE/MARKETING MANAGER]

Code			Strongly disagree			Strongly agree	It's difficult to say	Negative opinion	Positive opinion	Average (1-4)
			1	2	3	4	-			
QE1	The game helps me to understand [international exchange with cost-and labor product/marketing management: segmentation]	Trade (N=106)	0.9%	9.4%	44.3%	38.7%	6.6%	10.3%	83.0%	3.3 (n=99)
		Marketing Manager (N=102)	1.0%	5.9%	33.3%	56.9%	2.9%	6.9%	90.2%	3.5 (n=99)
QE2	The game clearly explains [the Heckscher-Ohlin theory/the idea of segmentation and marketing mix]	Trade (N=106)	7.5%	14.2%	38.7%	24.5%	15.1%	21.7%*	63.2%*	2.9 (n=90)
		Trade (without language barrier, n=65)	7.7%	9.2%	33.8%	29.2%	20.0%	16.9%	63.0%	3.1 (n=52)
		Marketing Manager (N=102)	12.7%	42.2%	38.2%	6.9%	0.0%	54.9%*	45.1%*	3.3 (n=95)

Note: students fills two different questionnaires about two games, but to make the presentation of the findings more clear, they are presented in one table. The average is only calculated for participants who ranked the game, and excluded the 'It's difficult to say'. Mark * means that there is a significant difference (p<0.05) between the percentage of Trade Ruler users and the percentage of Marketing Manger users in assessing the game positively or negatively

TABLE IV.
NAVIGATION AND EASE OF PLAYING

Code			Strongly disagree			Strongly agree	It's difficult to say	Negative opinion (1-2)	Positive opinion (3-4)	Average (1-4)
			1	2	3	4	-			
QN1	I find this game simple to play	Trade (N=106)	0.9%	3.8%	22.6%	72.6%	0.0%	4.7%	95.2%	3.7 (n=106)
		Marketing Manager (N=102)	1.0%	1.0%	24.5%	71.6%	2.0%	2.0%	96.1%	3.7 (n=100)
QN2	I easily find information which I need	Trade (N=106)	1.9%	15.1%	46.2%	34.0%	2.8%	17.0%	80.2%	3.2 (n=103)
		Marketing Manager (n=102)	2.9%	12.7%	41.2%	41.2%	2.0%	15.6%	82.4%	3.2 (n=100)
QN3	Without any problems and I easily established my score in this game	Trade (N=106)	0.9%	9.4%	26.4%	63.2%	0.0%	10.3%*	89.6%	3.5 (n=106)
		Trade (without language barrier, n=65)	0.0%	9.2%	23.1%	67.7%	0.0%	9.2%	90.8%	
		Marketing Manager (n=102)	1.0%	2.0%	32.4%	57.8%	6.9%	3.0%*	90.2%	3.6 (n=95)

1. Positive perception of the educational content is interlinked with the belief that introducing the games into the university curriculum increases the effectiveness and the engagement of the students.
 2. Ease of playing the game is correlated with positive emotions during learning process.
 3. The interactivity of the game is linked with the perceived effectiveness of game-based learning, the student's engagement in learning, and positive emotions.
 4. Graphic design is correlated with positive emotions during the learning process.
 5. Player satisfaction is correlated with interactivity, the design, the perceived total quality of the game, the educational content of the game and the ease of navigation.
 6. Player satisfaction is correlated with the perceived effectiveness of learning, the engagement in learning, and positive emotions connected with the learning process.
- Therefore the general hypotheses were confirmed. Although there are variables within main constructs which were not interlinked as we presumed.

TABLE V.
DESIGN

Code	I asses ...		Very low			Very high	Negative opinion	Positive opinion	Average (1-4)
			1	2	3	4			
QD1	Interactivity of the game	Trade (N=106)	2.8%	17.0%	59.4%	20.8%	19.8%	80.2%	3.0
		Marketing Manager (N=102)	2.0%	9.8%	55.9%	32.4%	11.8%	88.3%	3.2
QD2	Graphic design	Trade (N=106)	13.2%	31.1%	30.2%	25.5%	44.3%	55.7%	2.7
		Marketing Manager (n=102)	4.9%	31.4%	40.2%	23.5%	36.3%	63.7%	2.8
QD3	General quality of game design	Trade (N=106)	6.6%	27.4%	44.3%	21.7%	34.0%*	66.0%*	2.8
		Trade (without language barrier, n=65)	7.7%	29.2%	44.8%	18.5%	36.9%	66.3%	2.7 (n=65)
		Marketing Manager (n=102)	1.0%	14.7%	52.9%	31.4%	15.7%*	84.3%*	3.1

TABLE VI.
SATISFACTION FROM PLAYING THE EDUCATIONAL GAME

Code	Assesses ...		Very low			Very high	Negative opinion	Positive opinion	Average (1-4)
			1	2	3	4			
QS	Satisfaction from playing	Trade (N=106)	3.8%	17.9%	50.9%	27.4%	21.7%*	78.3%*	3.0
		Trade (without language barrier, n=65)	6.2%	13.8%	55.4%	24.6%	20.0%	80.0%	3.0
		Marketing Manager (n=102)	1.0%	7.8%	55.9%	35.3%	8.8%*	91.2%*	3.3

TABLE VII.
ENHANCED LEARNING PROCESS [TRADE/MARKETING MANAGER]

Code			Strongly disagree			Strongly agree	It's difficult to say	Negative opinion (1-2)	Positive opinion (3-4)	Average (1-4)
			1	2	3	4				
QL1	The game builds my interest in [economics/marketing management]	Trade (N=106)	2.8%	10.4%	33.0%	48.1%	5.7%	13.2%	81.1%	3.3 (n=100)
		Marketing Manager (N=102)	0.0%	6.9%	30.4%	54.9%	7.8%	6.9%	85.3%	3.5 (n=94)
QL2	Implementing the games similar to [Trade/Marketing Manager game] to the university curriculum would enhance the effectiveness of the learning process	Trade (N=106)	2.8%	5.7%	22.6%	65.1%	3.8%	8.5%	87.7%	3.6 (n=102)
		Marketing Manager (N=102)	1.0%	8.8%	16.7%	69.6%	3.9%	9.8%	86.3%	3.6 (n=98)
QL3	Implementing the games to the university curriculum would enhance my engagement in learning process	Trade (N=106)	2.8%	10.4%	28.3%	53.8%	4.7%	13.2%	82.1%	3.4 (n=101)
		Marketing Manager (N=102)	2.0%	7.8%	24.5%	59.8%	5.9%	9.8%	84.3%	3.5 (n=96)
QL4	Implementing the games to the university curriculum would link learning to positive emotions	Trade (N=106)	1.9%	5.7%	19.8%	67.0%	5.7%	7.6%	86.8%	3.6 (n=100)
		Marketing Manager (N=102)	1.0%	5.9%	31.4%	57.8%	3.9%	6.9%	89.2%	3.5 (n=98)

TABLE VIII.
THE CORRELATION BETWEEN VARIABLES – R SPEARMAN, $p < 0.05$. CORRELATIONS OF MODERATE STRENGTH ARE HIGHLIGHTED.

Trade		Marketing Manager	
Correlation between educational content and enhanced learning			
QE1-QL2	0.33	QE1-QL2	0.36
QE1-QL3	0.30	QE1-QL3	0.34
		QE1-QL4	0.35
		QE2-QL1	0.28
Correlation between navigation and enhanced learning			
QN3-QL1	0.21	QN1-QL1	0.25
QN2-QL2	0.26	QN1-QL2	0.24
QD2-QL2	0.21	QN1-QL3	0.27
QD3-QL2	0.29	QN1-QL4	0.33
		QN2-QL4	0.25
		QN3-QL4	0.26
Correlation between design and enhanced learning			
QD2-QL3	0.28	QD2-QL1	0.29
QD3-QL3	0.24	QD3-QL1	0.27
QD2-QL4	0.34	QD1-QL2	0.30
QD3-QL4	0.28	QD1-QL3	0.41
QD1-QL1	0.33	QD1-QL3	0.25
		QD1-QL4	0.43
		QD2-QL4	0.29
		QD3-QL4	0.23
Correlation between educational content and player satisfaction			
QE1-QS	0.25	QE1-QS	0.36
		QE2-QS	0.38
Correlation between satisfaction and design			
QS-QD1	0.44	QS-QD1	0.48
QS-QD2	0.38	QS-QD2	0.40
QS-QD3	0.37	QS-QD3	0.44
Correlation between satisfaction and navigation			
		QS-QN1	0.31
		QS-QN2	0.27
Correlation between player's satisfaction and enhanced learning			
QS-QL2	0.25	QS-QL1	0.24
QS-QL1	0.31	QS-QL2	0.35
		QS-QL3	0.38
		QS-QL4	0.40

Note: while both variables have the option 'It's difficult to say' the correlation was calculated using the full scale. If only one variable had the option 'It's difficult to say' the correlation was calculated with the exclusion of answers "It's difficult to say"

IV. CONCLUSIONS

The main conclusions of the study:

- Introducing 'one-hour-play' simulation games into the university curriculum would be connected with positive educational outcomes such as increased student engagement in learning, positive emotions, and the perceived effectiveness of learning. This means that 'one-hour play' games (the games tested were assessed to be simple to play by over 95% of students) - which are more affordable and easier to prepare than

very complex multi-modul simulations games - can be useful tools for introducing managerial or economic issues to students.

- Unfortunately – as our survey also showed – very few students have had previous experience in using the games as the part of their courses and games are a neglected educational tool in the Polish universities. Perhaps this is one of the reason why participants of our survey evaluated the games so favorably. Students were very enthusiastic about the games and they assessed them

very highly in different areas, especially their the educational content, simplicity and interactivity.

- Our survey shows there is a positive link between the player satisfaction and perceived enhancement of the learning process. It suggests that when there are two or more different games for evaluation it may be worth focusing more on measuring general satisfaction than on a particular feature of the game.
- The finding emphasis the importance of game design. Interactivity, graphic design and general quality of the game design can influence the player satisfaction.

There are a few limitations for study presented. First of all, the size and the process of choosing the participant sample limit the way in which results of the study can be interpreted and generalized. Also the study did not include some variables which could influence the results including a student's level of achievement at university and learning style. Future studies should extend the scope of analysis.

REFERENCES

- [1] Derryberry A. (2007), Serious games: online games for learning, Adobe White Paper [online], http://www.adobe.com/resources/elearning/pdfs/serious_games_wp.pdf [01.04.2013]
- [2] Hwang G.-J. & Wu P.-H., Advancements and trends in digital game-based learning research: a review of publications in selected journals from 2001 to 2010, *British Journal Of Educational Technology*, January 2012;43(1):E6-E10
- [3] Lin Y.-L. & Tu Y.-Z. (2012). The values of college students in business simulation game: A means-end chain approach, *Computers & Education*, 58(4), 1160-1170
- [4] Pasin F. & Giroux H. (2011). The impact of a simulation game on operations management education, *Computers & Education*, August 2011;57(1):1240-1254.
- [5] Simões J., Redondo R. & Vilas A. (2013). A social gamification framework for a K-6 learning platform, *Computers In Human Behavior*, 29(2), 345-353
- [6] Tao Y.-H., Cheng C.-J. & Sun S.-Y. (2009), What influences college students to continue using business simulation games? The Taiwan experience, *Computers & Education*, November 2009;53(3):929-939
- [7] Tao Y.-H., Yeh C. R. & Hung K. C. (2012) Effects of the heterogeneity of game complexity and user population in learning performance of business simulation games, *Computers & Education*, December 2012;59(4):1350-1360.
- [8] Wu W.-H., Chiou W.-B., Kao H.-Y., Hu C.-H. A. & Huang S.-H. (2012), Re-exploring game-assisted learning research: The perspective of learning theoretical bases, *Computers & Education*, December 2012;59(4):1153-1161.
- [9] Rouse III R. (2005), *Game Design: Theory & Practice*, Second Edition, Wordware Publishing, Inc., 2005, xx-xxi
- [10] Voorveld H, Neijens P & Smit E. (2011) The Relation Between Actual And Perceived Interactivity, *Journal of Advertising*, Summer 2011 2011;40(2):77-92