

EXPERIENCING A MOBILE GAME AND ITS IMPACT ON TEACHERS' ATTITUDES TOWARDS MOBILE LEARNING

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ABSTRACT

This paper describes a workshop held as part of preparations for a large scale implementation of a mobile game designed to support learning of the topic "my hometown". The study reveals teachers' attitudes towards the incorporation of smartphones in teaching and learning in school and whether these attitudes changed after experiencing the game. The findings show that the attitudes of the teachers towards the game were positive in all aspects. They thought it was enjoyable, promoted collaboration and created motivation to win. The game was evaluated as contributing to knowledge and the application as easy to use. The study revealed that teachers' attitudes towards the use of smartphones for learning were changed after experiencing the game as participants. Perceptions about the potential of smartphones for learning strengthened and there has been an increase in the willingness to adopt them as part of the student's personal learning toolkit.

KEYWORDS

Mobile games, game-based learning, teachers, adoption of technology, resistance to mobile-technologies, BYOD.

1. INTRODUCTION

This paper describes a workshop held as part of preparations for a large scale implementation of a mobile game. The activity designed to support learning of the topic "my hometown" which is a compulsory annual theme in the 4th grade's national curriculum in Israel. Twenty six schools from the same city took part in a treasure hunt game, activated via mobile phones, designed to support the final event summarizing the topic. Teachers were supposed to conduct the game independently in their own schools. The workshop was conducted in order to familiarize the teachers with the activity and to train them to enact it in their own schools.

The study focuses on the impact of the experience on teachers' attitudes towards the use of smartphones in school in general and toward the game in particular.

1.1 Learning through Games

Gamification of learning weaves together elements of gaming in educational contexts in order to strengthen and enhance the activity of users and engage students in learning (Gee, 2003; Malone, 1981). Gamification contributes to active learning, creative thinking and concentration. The game may also provide the means to acquire new knowledge and problem-solving skills (Ricci et al, 1996). Multi-players social games are of an important social value and contribute to the social and moral development of the person. During games the participants learn to respect and follow rules as well as to lose with dignity. Social games may also encourage cooperation among the participants (Garris et al.2002; Gee, 2008).

1.2 Using Smartphones for Mobile Learning

Smartphones offer high potential for teaching and learning (Prensky, 2005; Traxler 2007). Students use them increasingly in everyday life. The market penetration rate of the smartphone among American adults in 2015 was 65%. Among youngsters (ages 18-29) it was 85% (Smith, 2015). 88% of American teens (ages 13 to 17)

had access to a mobile phone of some kind in 2015 (Lenhart et al., 2015). Teachers can take advantage of the availability of smartphones to create an interactive and interesting learning experience. By utilizing the special features of the phones, the teacher can create a new learning experience and engage students in the classroom and outside it and thus increase learning motivation among students (Jones et al. 2006). Smartphones can enrich learning by providing authentic and contextual learning conditions (Sharples et al., 2010). Learning through mobile devices can be spontaneous and needs driven. It offers new possibilities for learning: learning outside the classroom, learning anytime and anyplace and learning on the move (Liu et al, 2014). The only constraints that limit the use of mobile phone is bad reception conditions, since reception is still not possible in certain places and the duration of the battery (Meishar-Tal & Gross, 2014).

1.3 Mobile Location-Based Services and Location Based Games

One of the main advantages of using mobile devices for learning purposes is their ability to integrate location based information in the learning process. The location based services are either based on the use of QR code scanning or on global positioning services (GPS) that is built-in in smartphones. QR codes and GPS are used in educational contexts in closed spaces such as museums as well as in open spaces such as field trips (Schultz, 2013; Fitz-Walter, 2012; Avouris & Yiannoutsou, 2012). They are effective means for attaching virtual information and activities to physical objects or specific locations.

One of the most popular location-based applications is the game "Treasure Hunt" (Lai et al., 2013; Wu et al., 2010). In this game the players have to follow a set of stations by solving clues pointing on their locations. The game has a competitive element that contributes to motivation and enjoyment of learning (Ihamäki, 2014). Researches indicate that such games also improve the participants' spatial knowledge and navigation skills (Winter et al, 2011).

1.4 Teachers' Attitudes towards the Use of Smartphones for Learning Purposes

Recognition of the pedagogical potential of using smartphones for learning gave rise to BYOD (bring your own device) policy in schools. According to this policy, students bring a personally owned mobile device to school as part of their personal learning toolkit and use it for varied learning purposes (Song, 2014; Vanwelsenaers, 2012). Nevertheless, many schools and many teachers oppose the use of smartphones at school. The most common reason for their objection is that smartphones are distractive and therefore reduce attention and concentration in class (Baker et al., 2012; Lenhart et al., 2010; Thomas, O'bannon & Britt, 2014). This disrupting effect does not only harm students but also raises problems to teachers and their ability to control the class (Sad & Goktas, 2014). Other reasons for resistance to the use of smartphones in school are the teachers' beliefs that these devices are used for cheating, allow access to inappropriate sites and constitute channels for cyberbullying (Thomas & O'bannon 2013; Thomas, O'banon & Britt, 2014).

Mobile phones are seen by many teachers only as means for recreation and entertainment and not for learning. Nevertheless, looking at the level of resistance of teachers to use smartphones in class shows constant decrease over the years (O'bannon & Thomas, 2015). As teachers become more aware of the pedagogical potential of smartphones, their anxiety level is reduced. The higher their competence of using these technologies, the higher is their willingness to use them for teaching and learning (Mac Callum & Jeffrey 2014).

2. THE WORKSHOP

The game "my hometown" is a location based game using Treasure-HIT, an application designed for creating and enacting mobile treasure hunt games for learning (Kohen-Vacs, Ronen & Cohen, 2012).

The game aimed to meet the challenge of actively engaging 4th grade students from 26 elementary schools (about 3000 students), taking into account the practical constraints and limitations. Since security considerations prevented leaving the school quarters, the game was designed as an in-school activity based on visual information presented by posters spread out in a specific large space (the schoolyard, a large hall or

a corridor). Each poster covered a different aspect of the topic: the city geography, history and symbols. Each poster was marked by a QR code used to identify the station by the app mechanism.

The game was presented as a competition between the teams. The players had to sign up as teams of three through the Treasure-Hit app. The launching activity provided a clue to the first station (poster) assigned to the team. After locating the right station by recognizing the visual information on the poster, the players had to scan the code in order to confirm arrival. If the players reached the right station they were challenged with several activities related to the site, otherwise, they got an error indication and had to continue searching for the right station. The clues leading to the next station were presented only after successfully completing all the activities at the station. The ranking of the teams was determined by the system, taking into account both the time and number of mistakes.

A workshop was conducted in order to familiarize teachers with the activity and to train them to enact it with their students in their school. During the workshop the teachers first played the game in teams of three, exactly as it was planned for students (Figure 1). Then they were instructed how to conduct the game with students in their own schools.



Figure 1. Teachers' playing the game

3. THE STUDY

This study aimed to reveal teachers' attitudes towards the incorporation of smartphones for teaching and learning and whether these attitudes changed after experiencing the game. The study focused on the following questions:

1. What were teachers' opinions about the game and its potential for learning?
2. What were teachers' attitudes towards using smartphones in educational contexts prior to the workshop and what is the relation between these attitudes and their commonly practiced teaching methodologies?
3. To what extent were teachers' attitudes changed after the workshop?
4. What are the relations between the resistance to use smartphones in school learning and teachers' attitudes in other aspects?

3.1 Research Method and Tools

The study was based on a Pre-test questionnaire administered before the workshop, a Post-test filled in after the workshop. The first part of the Pre-test questionnaire collected teacher's background information (school, job, teaching discipline and teaching experience). In the second part (thirteen 1-5 Likert scale statements) the teachers were asked to report on their preferred and common teaching methodologies and to express their attitudes towards the use of smartphones for school teaching and learning.

The Post-test questionnaire consisted of three parts: teacher's personal impression of the mobile game they have just experienced, evaluation of its pedagogical potential for students and attitudes towards the use of smartphones for learning. The third part was identical to the questions they have been asked in the Pre-test.

3.2 Participants

Thirty five teachers (3 male and 32 female) representing 22 schools across the city participated in the workshop. Twenty seven of them completed both questionnaires. The average seniority of the teachers was 15 years, ranging from a 2 to 36. Their main teaching disciplines were language (48%), general education (17%), math & sciences (14%) and religious studies (8%).

4. FINDINGS

4.1 Teachers' Evaluation of the Game

After playing the game the teachers were asked to express their opinions on the activity, based on their personal experience. They were given five statements which refer to different aspects: enjoyment, cooperation, motivation to win, ease of use and knowledge acquisition and had to rate them on a 1-5 Likert scale. The results are presented in Table 1.

Table 1. Teachers' opinions of the game

	Mean	SD
My team mates cooperate during the game	4.90	.30
I enjoyed the game	4.87	.34
I was eager to win	4.68	.65
The game was easy to operate	4.45	.77
I learned new things	4.23	.88

The teachers expressed a high level of satisfaction, enjoyed playing, felt engaged and eager to win. The most powerful experience of the teachers was the cooperation between members of the team created during the game. The least powerful aspect (although still ranked high) was learning new things, probably because, as expected from them, the teachers already mastered the subject. These impressions were supported by teachers' reactions during the games as well as by their remarks in the sample interviews.

At the end of the activity the teachers were asked to express their views in regard to the level of difficulty of the game. They had to choose between three options: "too difficult", "fits the level of my students" or "too easy". 24 Teachers thought the game fitted the students' level. Only 3 teachers evaluated the game as too difficult for their students. None of the teachers thought the game is too easy.

In addition, teachers were asked to evaluate the pedagogical potential of the game regarding seven aspects: competitiveness, development of 21st century skills, acquiring new knowledge, relevance, cooperation, out of classroom learning and active learning. The findings (Table 2) show that the game was perceived as offering a high pedagogical value on all aspects.

Table 2. Evaluation of the pedagogical potential of the game

Aspect	Mean	SD
Encourages competitiveness	4.81	0.40
Develops 21st century skills	4.68	0.60
Means of learning new things	4.65	0.49
Relevant for my students	4.58	0.62
Encourages cooperation within group	4.52	0.72
Use the outdoor environment effectively	4.52	0.63
Constitutes active learning	4.45	0.68

4.2 Teachers' Attitudes towards using Smartphones in Educational Contexts prior to the Workshop

The teachers were asked to express their attitudes and opinion about the potential and challenges of using smartphones for learning in school by responding to seven statements on a scale of 1-5. The findings are presented in Table 3.

Table 3. Teachers' attitudes towards the use of smartphones in school (N=30)

Attitudes (Pre-test)	Mean	SD
Positive aspects		
Contribution to experiential learning	4.03	0.85
Contribution to motivation	3.93	0.87
Contribution to learning	3.46	0.88
Mean	3.79	0.75
Negative aspects		
Cause distraction	2.93	0.94
Harm teachers' ability to manage class	2.27	0.83
Mean	2.60	0.78
Use in school		
Smartphones should be part of personal learning toolkit	2.83	0.95
I oppose use of smartphones in school	1.71	0.94

The findings suggest that teachers perceive the positive contributions of using smartphones significantly higher than their negative consequences ($t(29) = 5.59, p < 0.001$). The opinion that smartphones should be part of the student's personal learning toolkit was significantly higher than the opinion that opposes their use in school ($t(29) = 4.32, p < 0.001$). Nevertheless, in this case both opinions received only moderate to weak ratings while only about 25% of the teachers favor using smartphones as part of students' personal learning toolkit.

In order to explore the relations between these attitudes and their commonly practiced teaching methodologies a Pearson correlation test was conducted. The findings show that attitudes towards the use of smartphones were related to the commonly practiced teaching methodologies in three aspects:

The more teachers use smartphones for learning the higher is their perception of the contribution of the mobile phones for learning ($r = 0.566, p < 0.05$). The more teachers use games in learning, the higher is their perception of the contribution of the smartphone for learning ($r = 0.534, p < 0.005$), contribution to motivation ($r = 0.378, p < 0.05$) and contribution to experiential learning ($r = 0.454, p < 0.05$). The more teachers practice frontal teaching approaches, the higher they perceive smartphones as disrupting teacher's ability to manage the class ($r = 0.477, p < 0.001$).

These findings suggest that teachers' attitudes towards the use of smartphones for school learning are related to their pedagogical conceptions and their practice. As teachers who are open to alternative learning pedagogies through games, consider more favorably the use of smartphones and recognize their contribution to learning while teachers that use more traditional pedagogies see these personal devices as a threat to their ability to manage the class.

4.3 Differences between Teachers' Attitudes before and after the Workshop

The comparison between teachers' attitudes before and after the workshop during which they have experienced the mobile game is presented in Table 4. It seems that the biggest change in teachers' attitudes refers to the positive contribution of smartphones to learning. After participating in the activity, smartphones were perceived as more exciting and contributing to learning. The opinion that mobile technology should be part of the student's personal learning devices was significantly strengthened as well.

Nevertheless, one can see that the reject positions and perception of negative effect of using smartphones in learning have not weakened as a result of the workshop and even strengthened slightly although insignificantly.

Table 4. Differences between teachers' attitudes before and after the workshop (N=27).

Aspect	Before	After	T-test
Positive aspects			
Contribute to experiential learning	4.08	4.42	2.36, p<0.05
Contribute to motivation	4.04	4.08	NSD
Contribute to learning	3.52	3.92	2.24, p<0.05
Negative aspects			
Cause distraction	2.85	2.85	NSD
Harm of teachers' ability to manage class	2.24	2.36	NSD
Use in school			
Smartphones should be part of personal learning toolkit	2.92	3.38	2.60, p<0.05
I oppose use of smartphones in school	1.63	1.81	NSD

These results indicate that the gaming experience emphasized the advantages of learning through personal mobile technology, but did not provide solutions for the problematic aspects in other contexts. Apparently, the reluctance of some teachers to use mobile technologies in the classroom does not stem from a lack of exposure to the new technologies and acknowledging their pedagogical potential but from other matters that weren't investigated in this study.

4.4 Resistance to Smartphone and to the Game

The overall resistance to the use of smartphones in school was quite low even before the game ($m = 1.63$) and also after it ($m = 1.81$). This resistance seems to be related to other attitudes as shown in Table 5.

Table 5. Relation between resistance to the use of smartphones in school and other attitudes

Attitudes	Correlation r, p
Cause distraction	.396, p < 0.05
Contribution to learning	-.515, p < 0.005
Contribute to motivation	-.553, p < 0.05
Contribute to experiential learning	-.570, p < 0.05

The results show that resistance to the use of smartphones in school is related to perceptions about the distractive effect of this technology and negatively related to the level of acknowledgement of the contribution of technology to learning to contribution of smartphones to motivation and to experiential learning. Surprisingly oppositional attitude wasn't significantly associated with perceptions of harm to the teacher's ability to manage class.

We have also examined whether the resistance to the use of smartphones in school after experiencing the mobile game was related to the evaluation of the specific game played during the workshop. A negative significant correlation was found between resistance to the use of smartphones in school and the perceived contribution of the game to learning ($r = 0.136$, $p < 0.05$).

5. SUMMARY AND CONCLUDING REMARKS

The purpose of this study was to examine the teachers' attitudes towards a mobile "Treasure Hunt" game operated via smartphones and the impact of experiencing the game on their attitudes towards the use of smartphones in school.

The findings show that the attitudes of the teachers towards the mobile game were positive in all aspects. They thought it was enjoyable, promoted collaboration and created motivation to win. The game was evaluated as contributing to knowledge and the application as easy to use. It can be said that the game complied with the defined goals and the design principles of a competitive games (Vorderer et al, 2003; Gee, 2008).

The study also revealed that teachers' attitudes towards the use of smartphones in learning were changed after experiencing the game as participants. Perceptions about the positive effects of using smartphones on learning got stronger and there has been an increase in the acceptance of smartphones as part of the student's personal learning toolkit. These findings support previous studies showing that exposure to successful uses of smartphones in learning reduces resistance and increases willingness to use these devices in teaching (Mac Callum & Jeffrey, 2014).

Resistance to the use of mobile technology in this study was quite low even before the experience, as claimed by O'Bannon and Thomas (2015) that the degree of resistance of teachers to use smartphones at school declines over the years. Resistance to smartphones use in learning has been found to be related to the level of perceiving the device as distracting. These findings support previous studies that identified distraction as a major cause of resistance to use the technology in schools (Baker et al., 2012; Lenhart et al., 2010; Thomas et al., 2013).

The study indicated that teachers' inhibitions about using smartphones in learning are related to their teaching practices. Teachers that favor frontal teaching hold stronger perceptions against smartphones. They fear of losing control of the teacher in class. Further study will be able to examine in depth more factors that hinder teachers' use of smartphones in learning. Regarding the population of this study, it will be interesting to follow their embracement of smartphones in teaching in other contexts than that specific game they have been trained to operate.

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