



Exploring mobile tablet training for road safety: A uses and gratifications perspective



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ARTICLE INFO

Article history:

Received 31 January 2013

Received in revised form

11 September 2013

Accepted 13 September 2013

Keywords:

Training

Mobile learning

Gratification

Innovativeness

ABSTRACT

Traffic injuries are predicted to be the fifth leading cause of death and injury by 2030 if no further action is taken. Generation Y, who are growing up with technology and Internet, are among the most vulnerable road users, so it is crucial to provide effective road safety training for them. In the light of the Uses and Gratification Theory (U&G), we propose a conceptual research model to measure how users' different needs and gratifications with mobile technologies impact their learning outcomes. A field study with 182 young drivers who participated in a mobile road safety training program was conducted just before they took their license exam on site. A structural equation modeling (SEM) approach was utilized to test the research model. Perceived information needs, user preference, and innovativeness were found to have significant mediating relationships with user perceived multimedia enjoyment, and effectively promoted higher-order learning outcomes. The discussion focuses on the importance of designing multimedia content with the latest mobile technologies to effectively engage young users.

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1. Introduction

New technologies and digital media have significantly impacted learning (Gee, 2009). Recent mobile technologies such as Apple's iPads have started to revolutionize educational field as 'game changers,' and many K-12 schools and higher education institutions have adopted iPads for teaching and learning, however, more attention should be paid to instructional content and App design that affect student learning pathways (Falloon, 2013; Ihaka, 2013). The use of new digital technologies in education has been shown to increase cognitive engagement and enhance learning (Ellis & Barrs, 2008). Generation Y refers to a generation spanning in age from 18 to 32 (Fox & Jones, 2009), who grew up with technology and the Internet at a very early age. According to the Kaiser Family Foundation (2010), "without question, this generation truly is the media generation, devoting more than a quarter of each day to media." Given this, educators should harness the power of cutting-edge digital multimedia technologies to enhance training and learning outcomes.

Although emerging mobile devices, including tablet technologies, are gradually becoming integrated into teaching and learning, little is known about the impact of these technologies on learning outcomes (Park, Parsons, & Ryu, 2010) and how they can be effectively used to support learning (Kukulska-Hulme & Shield, 2008). Ryu and Parsons (2012) suggested that mobile learners could benefit beyond the traditional learning experience. Due to the high injury and death rate of young drivers on the road worldwide, it is crucial to allocate resources and conduct effective road safety training programs for digital natives (Longo, Hewett, Ge, & Schubert, 2005). This study was designed to test the impact of mobile technologies on road safety training. It draws on the Uses and Gratification Theory (Blumler & Katz, 1974), which posits that individuals use particular forms of media to meet specific cognitive, affective, personal integrative, social integrative, and tension-free needs. According to Bryant and Miron (2004), if these needs are fulfilled, people are more likely to repeat the experience. We thus examine whether user interactions with a multimedia training program accessed via tablets provide more motivation to learn, and eventually help users to achieve higher-order learning outcomes. Further, study results may inform more mobile training design and delivery.

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This article is organized as follows. This paper begins with an exposition of the importance of road safety training programs among Generation Y. Following the theoretical background, we propose a research model to investigate how user information needs for training, innovativeness, new and cool perceptions of using mobile technologies, user preferences, and user perceived enjoyment affect training outcomes. A structural equation model (SEM) analysis was run to test the research model. The majority of the hypotheses were significantly supported. Lastly, future research directions are discussed.

2. Road safety background

2.1. The importance of road safety training for motorcycle riders

Internationally, motorcyclists and scooter riders constitute an approximate population of 313 million (Haworth & Rowden, 2010), and are among the most vulnerable road users, accounting for 46% of road traffic deaths (Krug, 2012). A recent United Nations Road Safety Collaboration report (2011–2012) indicates that over 30% of road crash victims are young people under the age of 25. In Israel, 43% of the young drivers are involved in a crash which they are responsible for. Further, although there is a 30% decrease in road crash fatalities in the last decade, the percentage of motorcycles users that die increased by 17%. This trend is similar within the world population (Houston et al., 2011).

The lack of experience of many motorcycle riders has been cited as a potential cause of motorcycle crashes (Haworth & Rowden, 2010; Winn, 1987). Thus, the training of motorcycle riders has been identified as an important countermeasure for reducing both the number of crashes and the severity of injury (Noordzij, Forke, Brendicke, & Chinn, 2001). Pre-license motorcycle rider training courses have been made compulsory in several countries (Haworth & Rowden, 2010). However, riding a motorcycle continues to be associated with a high risk of fatal collisions, particularly in new riders.

2.2. Road safety education

Road safety education (RSE) is viewed as a means of improving the safety of young road users. The design and delivery for RSE education is often based on the assumption that young road users lack the skills, knowledge or both to operate safely in traffic environments, and that addressing these deficits will reduce their risk of being injured or killed while on the road (Houston et al., 2011). Hence, road safety education for young road users has become a priority for countries associated with the Organization for Economic Co-operation and Development (OECD) countries (OECD, 2004), including the United States, Canada, Australia, France and the United Kingdom.

In general, “Road Safety Education” programs encompass a large range of activities and methodologies for addressing road safety issues, such as risk awareness, one-time interventions (e.g., police or fire services using shocking imagery or exhibitions to portray crash consequences), and driver training, amongst others.

3. Theoretical background

3.1. Uses and Gratifications Theory

User needs are considered as an important aspect of personal psychology that shapes new media behavior. The Uses and Gratifications theory (U&G) of media use assumes that audiences are aware of their social and psychological needs, and actively seek the media to fulfill them (Palmgreen, 1984). Scholars have started to recognize the importance of applying the U&G to new media and digital technologies (Grellhesl & Punyanunt-Carter, 2012; Ruggiero, 2000) and Internet-related research (Chua, Goh, & Lee, 2012; Ko, Cho, & Roberts, 2005; LaRose & Eastin, 2004; LaRose, Mastro, & Eastin, 2001). Ruggiero (2000), meanwhile, argued that “as new technologies present people with more and more media choices, motivation and satisfaction become even more crucial components of audience analysis” (p. 14). In this regard, the U&G is seen as beneficial in exploring these questions, because its principal elements include people’s psychological and social needs, as well as how media can gratify the needs and reasons for communicating (Rubin, 2009). The U&G holds that multiple media compete for users’ attention, and that audience members select the medium that best meets their needs, such as information, emotional connection, or status (Tan, 1985).

3.2. Mobile learning

Mobile learning has extended learning beyond traditional classroom environments to those spaces where learners desire to learn in the workplace, at home and any other convenient places at any time (Traxler, 2010). Today’s mobile technologies have liberated learners from being constrained to a fixed location and time, while still connecting people with each other (Motiwalla, 2007). This is because mobile devices have redefined the learner’s perception about the enactment of anywhere, anytime.

Previous studies have defined mobile learning as being “just-in-time” situated learning, which is mediated through digital technology in response to the needs of the user (Laurillard, 2002). However, what makes mobile learning different from other forms of technology-supported learning is the way it can mediate and facilitate the learning experience (Peters, 2009). Based on a review of the literature, Melhuish and Falloon (2010) identified the following mobile learning advantages:

- (1) *Portability*: because of its light weight, mobile devices are easy to carry anywhere, anytime, and can potentially change our way of learning and work;
- (2) *Affordable and ubiquitous access*: due to increasingly affordable prices, many people have their own mobile devices, which also offer ubiquitous access to the web and many other functionalities for learning;
- (3) *Situated, “just-in-time” learning opportunities*: mobile technologies can be used to access and process information anytime and anywhere (VanT Hooft, 2008);

- (4) *Connection and convergence*: mobile devices enable people to connect with others, devices, networks and technologies;
 (5) *Individual and personalized experiences*: mobile devices offer individuals "unique scaffolding that can be customized to the individual's path of investigation" (Peters, 2009, p. 117). Furthermore, mobile learning applications can be customized to learning topics and themes.

4. The research model and hypotheses

To probe the ways in which mobile technologies can mediate and facilitate a road safety education program for digital natives, we examined how "perceived information needs," "user preference" "new and cool trends," and "innovativeness," factors affected training outcomes. We predicted that all these factors would positively impact the training outcomes, and that user perceived multimedia enjoyment would play a mediating role during the training process. In this section, each factor is further elaborated. The proposed research model is depicted in Fig. 1.

We argue that people who are exposed to a mobile training program prior to their license tests are likely to acquire more knowledge, and that this knowledge can be acquired through the multimedia content provided on tablets. A short explanation was provided for participants who has never used such a device, or any other device, before.

According to the U&G (Marston, 2010), users' needs and gratifications can be broken down into five categories: (1) *cognitive needs*; (2) *affective needs*; (3) *personal integrative needs*; (4) *social integrative needs*; (5) *tension free needs*. These categories formed the basis for our research hypotheses.

4.1. Cognitive needs

Cognitive needs reflect "a need to structure relevant situations in meaningful, integrated ways" and a need to understand and make an individual's experience meaningful (Cohen, Stotland, & Wolfe, 1955, p. 291). People use media to acquire specific knowledge and information during their learning processes, including the intellectual need to acquire knowledge to gratify their information needs (Marston, 2010). People have multiple ways of satisfy their information needs to achieve their learning goals, such as watching the news, or using search engines on the Internet without time restrictions. In this study, we regard an information need as a need for increased awareness among young drivers to improve their driving skills on the road. This includes an awareness of road transportation rules, identified road risks, and strategies for handling potential risks. The timing of the training may also facilitate the awareness of such a need.

The conceptualization of information needs covers both social and cognitive domains. The Anomalous State of Knowledge (ASK) theory, as proposed by Belkin (1980), suggests that the information needs of an individual are initialized as anomalies in a user's mind. Wilson (1981) suggested considering the social aspects of information needs. This feature is particularly pertinent to young drivers who are interested in knowing what happens to peers when riding motorcycles dangerously. Dervin (1999) suggested that information needs are triggered by users' attempts to make sense, and that needs change in the course of information seeking. Information relevance is a key to meeting users' information needs. The road safety organization involved in this study invested heavily in developing a multimedia training package, to include issues which are important to new motorcycle drivers. Learning to ride a motorcycle is different from learning to drive a car in which the teacher sits next to the learner, can control the car, and can provide immediate feedback. None of this is true for learning to ride a motorcycle. Thus, license applicants come to the exam without prior benefit from the instructional setting that is so relevant to young car drivers. Sundin and Johannisson (2005) described three approaches to relevance: (1) the structure approach views relevance as an

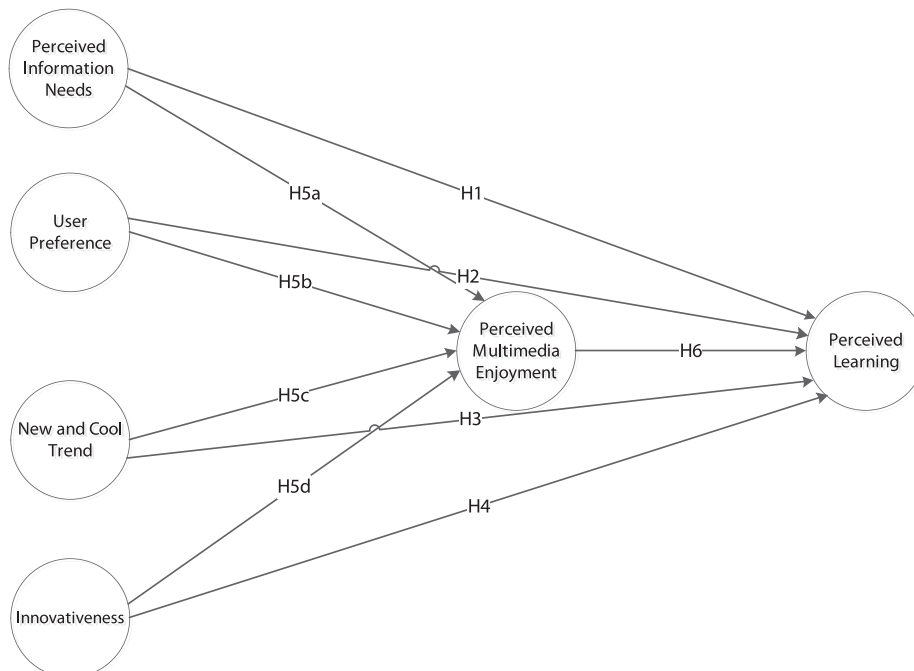


Fig. 1. Proposed research model.

objective assessment that fits a system-centered design of objectivity; (2) the individual approach is regarded as the user's determination of relevance that occurs during the process of information seeking; (3) the communication approach assumes that information seeking and the determination of relevance are shaped by individual cognitive reasoning. A mobile multimedia training program is relevant to young applicants waiting to take their exam, both for its information content and for its social appeal.

Prior research in the area of complex information needs and their features has been undertaken to gain insights into users' experiences of information technology (Skyrius & Bujauskas, 2010). This increased reliance on technology, combined with what we know about cognitive processing, offers considerable potential for instruction. Research has shown that the brain processes information through both visual and auditory channels. When information is presented using both channels, the brain can accommodate more new information. By taking advantage of this multimodal processing capability and technology-based tools, we may thus dramatically enhance learning through multimedia instruction and support information needs (Sweller, 2005). During a practical final exam, for instance, complex information needs may arise because individuals are required to fill in gaps in relation to perceptions of uncertainty, validation of facts, and features of the environment to achieve their goal (Pollock, Chandler, & Sweller, 2002). In this study, the participants were actual examinees waiting to take their motorcycle exams on site. The mobile road safety training program was therefore designed to provide them with an opportunity to acquire more knowledge about safe driving on the road, and get to know experts' points of view about road safety. This led to hypothesis 1:

H1: There is a positive relationship between information needs and perceived learning.

4.2. Affective needs

Affective needs include all kinds of emotions, such as pleasure and other moods. People use media to satisfy their emotional needs. Moreover, many commercial products can be dynamically customized and adapted by incorporating people's affective needs (Hancock, Pepe, & Murphy, 2005). It is well known that emotions have effects on learning (Bruton, 2003). In this sense, learning is associated not only with cognitive abilities, but also with emotions, expectations, prejudices, self-efficacy and social needs. Emotions further serve as a powerful vehicle for enhancing or inhibiting learning (Greenleaf, 2003), and may initiate, terminate, or disrupt information processing, resulting in selective information processing. Alternatively, they may organize recall. Different emotions can influence these mechanisms in different ways (Pekrun, Goetz, & Titz, 2002).

In addition to the above, research findings also indicate that positive emotions can enhance people's everyday lives. For example, researchers in organizational behavior, marketing, and management have found that positive emotions can lead to better decision-making behavior (Shin & Liu, 2007). Furthermore, such emotions have a considerable impact on learning, curiosity, and creative thought (Norman, 2004).

It may be stated that the affective dimension of preference for a product taps the user's emotions, moods and feelings towards an object (Norman, 2002). The behavioral dimension is defined as psychological (cognitive and affective) responses towards a product (Bloch, 1995). Compared to many other recent mobile technologies, tablets (i.e., iPads) provide more enjoyable user experiences than any laptop computer because of their appearance (which for many applications can mean better content and finer style). For example, tablets can offer a more immersive experience by adding more content pages, full-screen videos and slideshows with music, etc. Tablets are especially important for their ease of use such as multi-finger gestures (not mouse clicks), movement and orientation. The positive experience derived from the tablet training may also strengthen examinees' positive emotions, leading them to prefer using the tablet system, due to its mobility and light weight compared to traditional desktop and laptop computers. Emotions, then, are at the core of users' experience, and affect how people plan to interact with products, actually interact with products, and what kind of perceptions and outcomes surround these interactions (<http://www.sciencedirect.com/science/article/pii/S1071581906001935> Forlizzi & Battarbee, 2004). All of these preferences for using mobile tablet technology may directly and positively influence their learning. Thus, we hypothesize:

H2: There is a positive relationship between user preference and perceived learning.

4.3. Personal integrative needs

Personal integrative needs are a subcategory of the need for self-esteem. Using specific media in certain groups helps define members as 'cool' people, especially among digital natives, and preserves their status in society. We base our terminology of 'new and cool trends' on notions suggested by Papacharissi (2002). Young drivers may be interested in taking advantage of a mobile road safety training to increase their status among their friends by telling them they passed the exam by using a cool training program that was accessed via tablets.

The proliferation of mobile phones and other wearable media has challenged traditional conceptualizations of the relationship between communication technology and the body. Mobile phones are clearly different from most other interactive media because they can be worn on the body. Laptops are portable, as are mobile phones, but there is an important distinction to be made between portability and wearability. Both offer increased flexibility in terms of where and when one may connect with others; however, the latter affords communication while physically in motion, and this contributes to the personalization of mobile telephony to satisfy personal needs. As Vincent (2005, p. 120–21) explained, 'The very act of using a mobile phone involves the simultaneous engagement with more senses than we use for other computational devices as we simultaneously touch, hear and see via the mobile phone in order to keep in touch with our buddies.' This integration with the senses and corporeal attachment in turn opens up new forms of emotional attachment, and possibilities for symbolic representation of the self. Compared to other personal and portable technologies, the mobile phone tends to be regarded as characteristically stylish (Fortunati, 2005; Katz, Aakhus, Kim, & Turner, 2003). Mobile phones can symbolically represent the self through their brand, color, shape, ring tones, and ornaments of adornment. Young people are particularly known for embracing the mobile phone as a form of

symbolic expression (Alexander, 2000; Green, 2003; Lobet-Maris, 2003; Skog, 2002). Beyond personal flair, young people rely on the physical appearance of a mobile phone to represent social status and group affiliation (Skog, 2002), which may explain why the fashion of the technology is commonly determined through social network interactions (Campbell & Russo, 2003). Applying the Uses and Gratifications theory, Leung and Wei (2000) argued that major motives for mobile phone use are fashion and status, because the phone provides a means of symbolic expression of social identity.

People are beginning to enjoy the portability and immersive experience that small tablets offer over smartphones (Tofel, 2012). We are in an era of cloud computing and mobile devices, where consumers bounce easily from PCs and laptops to smartphones and now tablet devices. This is the idea behind “Internet2Go” (Sterling, 2010). It appears that users need a device that is mobile like a cell phone, but more robust in its function, while being more compact than a traditional personal computer (laptop). Designers realized that there is a need to access information on the go, but were unsure as to how users would interact with a device without the accepted use of a mouse or buttons (physical things that we can control to interact with a device). Humans tend to gesture toward things that they want, need, or are discussing (point), so a touch screen is an obvious way of interacting with the tablet. The touch screen interface allows users to turn a page in digital books or simply point/touch the object (app, URL, etc.) that they wish to interact with. In general, the tablets’ position serves to convince consumers that they are unique individuals who are detached from the cultural status quo, and march to the beat of their own drum. Indeed, there is a trend among tablet providers to present tablet consumers as an elite who adopt tablets to define their social identities. Therefore, we hypothesize:

H3: There is a positive relationship between a new and cool trend and perceived learning.

4.4. Social integrative needs

Social integrative needs refer to the need to socialize with others, including family, friends and relatives in society to strengthen one’s self-image. Today’s social networking media, for example, have made it possible for many users to meet their social integrative needs. A social need in which the innovativeness of the medium acts as a facilitator for social interaction may, indeed, be a sound reason to use tablet technology for training. Innovativeness may also directly contribute to the use of technology for training, so as to promote higher order learning outcomes. Gratification of the need to connect with others is further supported by the media (Chen, 2011). Here, the training program was a video featuring famous teenage actors who discussed road safety in a garage, so social features were pervasive in their discussions about increasing users’ road safety knowledge. For example, one of the actors described his experience in an accident. At a later stage, comments and feedback from the others were provided and a simulation of correct driving was depicted. This social facet serves to capture the audience’s attention, increase its absorption of the new knowledge, and foster learning (Wang, Tchernev, & Solloway, 2012).

4.5. Innovativeness

Innovation diffusion research has long recognized that highly innovative individuals are active information seekers about new ideas (Bass, 1969). This concept is related to the idea that individuals seek information about new and innovative decisions regardless of other people’s experiences (Rogers, 1983). Innovative individuals are able to cope with high levels of uncertainty, and develop more positive intentions toward acceptance (Rogers, 1983; 1995). The novelty seeking inherent to information delivered through tablet training is likely to prompt young drivers to search for new information that may translate into the actual acquisition of knowledge on road safety. Venkatraman and Price (1990) demonstrated that innovativeness is a cognitive process that creates a tendency to engage enjoyably in a new experience that stimulates thinking. Thus, we hypothesize:

H4: There is a positive relationship between innovativeness and user perceived learning.

4.6. Tension free needs

People may use media to escape and relieve tension. For instance, listening to relaxing music or watching favorite videos can be a tension free way to relax. Laurillard (2002) indicated that multimedia content can enhance students’ abilities to solve problems, and generally build confidence through practice. Multimedia content, moreover, has the attribute of interactivity, and this can engross users and enhance their enjoyment during training. Interactivity significantly strengthens the core U&G notion of the active user in that it reflects “the degree to which participants in the communication process have control over, and can exchange roles in their mutual discourse” (Williams, Rice, & Rogers, 1988, p.10).

Multimedia also delivers a multi-sensory interactive user experience, according to Neo and Neo (2004). Previous research has investigated how people learn, and whether cognitive style impacts information assimilation (IA) and user preference when using multimedia (Ghinea & Chen, 2003, 2006; Grimley, 2007).

The communication literature has defined six user-oriented dimensions of interactivity: threats (Markus, 1994), benefits (Ang & Cummings, 1994), sociability (Fulk, Flanagan, Kalman, Monge, & Ryan, 1996), isolation (Dorsher, 1996), involvement (Trevino & Webster, 1992), and inconvenience (Thomas, 1995). These dimensions are applicable to road safety training, in that our road safety training on tablets provides information on threats, benefits in term of tips acquired from the training, stimulates social discussion on the training itself (e.g., being presented as an encounter in which road safety scenarios are discussed), and prompts the audience to be more involved in the training material.

Therefore, we hypothesize thus:

H5: User perceived multimedia enjoyment will mediate users’ information needs, user preferences, new and cool trends, and innovativeness.

- H5a: User perceived multimedia enjoyment will mediate the relationship between information needs and perceived learning.
 H5b: User perceived multimedia enjoyment will mediate the relationship between user preference and perceived learning.
 H5c: User perceived multimedia enjoyment will mediate the relationship between new and cool trends and perceived learning.
 H5d: User perceived multimedia enjoyment will mediate the relationship between innovativeness and perceived learning.

4.7. User perceived multimedia enjoyment and learning

Multimedia viewing is an active process, which can be “a complex, cognitive activity that develops and promotes learning” (Marshall, 2002, p. 7). Mayer (2001) explains that “well-designed multimedia instructional messages can promote active cognitive processing in students, even when learners seem to be behaviorally inactive” (p. 19). Mayer (2005), meanwhile, states that people learn better from words and pictures than from words alone, in that the use of both words and pictures lets the brain process more information in working memory (Sweller, 2005). By using multiple channels of working memory, multimedia content may increase the likelihood that information will be effectively integrated into long term memory, and not lost. For example, multimedia instruction that includes animation can improve learning (Park, 1994; Tversky, Bauer-Morrison, & Betrancourt, 2002). Multimedia modes can take a variety of approaches, whether esthetic, logical or narrative, in addition to linguistic. They thus address the needs of a broader range of learners to achieve higher-order learning outcomes.

An asynchronous learning network study found that perceived enjoyment significantly impacts student learning outcomes, in that student perceived enjoyment is part of student motivation (Wu & Hiltz, 2004). Another online participatory examination study also indicated that students who perceived higher enjoyment reported higher order learning (Wu, Hiltz, & Bieber, 2010). Therefore, we hypothesize:

- H6: There is a positive relationship between user perceived multimedia enjoyment and perceived learning.

5. Research methodology and data analysis

5.1. Data collection procedure

We used mobile tablet technology for a road safety training experiment at the Ministry of Transportation Bureau where motorcycle license tests are held in Israel. Data collection took place during the months of June and July 2011. The Department at the Ministry and Transportation is responsible for training motorcyclists and developing video training packages for young drivers. Famous teenage actors were recruited to develop road safety videos.

Participants were recruited while waiting to take their motorcycle license exams, and participation was completely voluntary. We first asked the participants to fill out a pre-questionnaire to get their pre-perceptions about the road safety training. They were then asked to go through a 20-min training program on the tablet, which included four videos and simulations demonstrating road safety rules and potential dangers for motorcycles. The content was prepared by the Road Safety Authority. Following the tablet multimedia training, the participants were asked to complete a post-questionnaire designed to examine their perceptions of using the tablet technology and their assessment of the actual training outcomes. The post-questionnaire also included a test of knowledge about the training materials, to measure the examinee's learning outcomes. Fig. 2 presents a snapshot from the tablet road safety training interface, and Fig. 3 shows a user during training on site.

5.2. Subjects

In total, one hundred and eighty-two subjects were recruited. The average age was 24.76. Over 65% of subjects had more than four years of computer experience. About 42.9% had used tablets before they participated in this study. Among the respondents, about ninety-eight

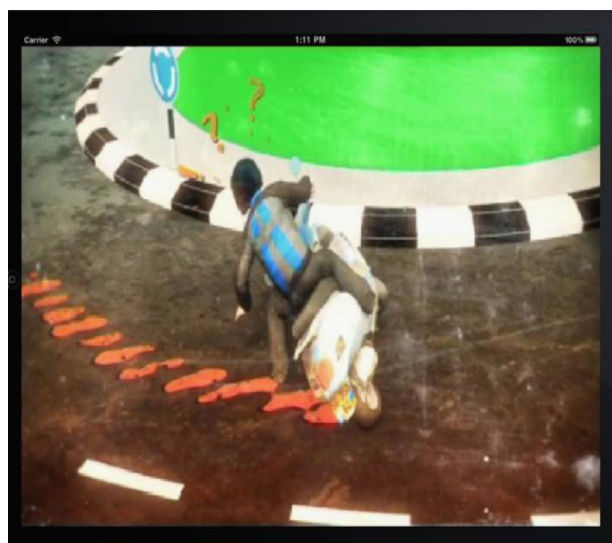


Fig. 2. A screen shot from the tablet Road Safety Training Program.



Fig. 3. A User Taking the Training Program on site.

percent were male and two percent were female. Seventy-eight percent of the participants recommended using the mobile tablet training program in the future (demographic data are presented in Table 1).

5.3. Adaptation of the constructs

The constructs were mostly adapted from the media and learning literature, and customized to the road safety training context. “Innovativeness” was adapted from [Byeng-Hee, Seung-Eun, and Byoung-Sun \(2011\)](#) including items related to fashion innovativeness and idea innovativeness. “Perceived learning” was adapted from [Wu and Hiltz \(2004\)](#) including items related to the learning outcomes, and we customized questions to the road safety context. “Information needs” were adapted from [Skyrius and Bujauskas \(2010\)](#). “User preference” was adapted from [Lee and Koubek \(2010\)](#), including items related to perceptions regarding preferences for the system, willingness to recommend the system to friends, preferring the system to other traditional systems. The “new and cool trends” construct was adapted from [Papacharissi \(2002\)](#)’s study on using the Internet as a media from a U&G point of view. The user “perceived multimedia enjoyment” construct was adapted from [Ruggiero \(2000\)](#)’s multimedia training study.

The full list of construct questions may be found in [Appendix 1](#).

5.4. Data analysis and results

The data analysis followed [Kline’s \(2011\)](#) two-step approach (i.e., a measurement model and a subsequent structural model) and used AMOS 18 to analyze the data. The adequacy of the items was assessed by convergent validity, composite reliability, and discriminant validity. Once the measures were validated, structural equation modeling (SEM) was used to test the validity of the proposed model. We first conducted a confirmatory factor analysis (CFA) with a maximum likelihood estimation to assess the measurement model by verifying the underlying structure of the constructs. To examine convergent validity, we tested whether all confirmatory factor loadings exceeded .70 ([Hair, Black, Anderson, & Tatham, 2010](#)). As [Table 2](#) shows, the level of internal consistency in each construct was acceptable, with

Table 1
Demographic characteristics.

	Category	Mean	S. D.	Frequency	Percent
Gender	Male			179	98.4%
	Female			3	1.6%
Age	16–30	24.76	8.29		
Years of computer and Internet experience	0	3.70	3.53	2	1.1%
	1			14	7.7%
	2			12	6.6%
	3			33	18.1%
	4			69	37.9%
	5			52	28.6%
Have you ever used tablet technology?	Yes	1.57	4.96	78	42.9%
	No			104	57.1%
The time allowed for the training was sufficient	1. Strongly Disagree	3.53	1.353	21	11.5%
	2. Disagree			21	11.5%
	3. Neutral			40	22%
	4. Agree			41	22.5%
	5. Strongly Agree			59	32.5%
Would you recommend using this form of training in the future?	1.Strongly Oppose	4.20	.962	3	1.6%
	2. Oppose			7	3.8%
	3. Neutral			30	16.5%
	4. Recommend			52	28.6%
	5.Strongly Recommend			90	49.5%

Cronbach's alpha estimates ranging from .748 to .829 (Hair et al., 2010). All of the composite reliabilities of the constructs were over the suggested satisfactory level of .72, ensuring adequate internal consistency of multiple items for each construct (Hair, Tatham, Black, Babin, & Anderson, 2006). In addition, the average variance extracted (AVE) of all constructs exceeded the minimum criterion of .50, indicating that a large portion of the variance was explained by these constructs (Hair et al., 2006).

The reliability of the survey instrument was established by calculating Cronbach's alpha values to measure internal consistency (see Table 2). Each construct was tested for reliability and content validity, using Cronbach's alpha (Cronbach, 1971). Most of the scores were above the acceptable level, which is above .70. Respondents were asked to rate each item on a five-point Likert scale, where one meant strongly disagree and five meant strongly agree. All the measures were based upon previously validated measures, so they are considered reliable. Reliability was evaluated using composite reliability values. Hair, Anderson, Tatham, and Black (1998) recommend an acceptable level of .70 for composite reliability; as summarized in Table 2, all of the constructs in the model had a value greater than .82. In fact, the square root of the AVE of each construct was larger than the construct's correlations with other constructs, which indicates good convergent and discriminate validity (Sánchez-Franco & Roldán, 2005).

For convergent validity (Table 2), two criteria should be met (Fornell & Larcker, 1981): (1) all of the factor loadings should not only be significant but should also exceed .70, and (2) the average variance extracted (AVE) by each construct should exceed the variance due to measurement error for that construct; i.e., the AVE should be greater than .50. As listed in Table 3, most items revealed loadings greater than .70 on their respective constructs. Thus, the two criteria for convergent validity were met (Bagozzi & Phillips, 1991).

Discriminant validity evaluates the extent to which a concept and its indicator variables differ from another concept and its indicator variables, and was assessed using the criteria suggested by Fornell and Larcker (1981): the square root of the AVE should be greater than the correlation shared between the construct and other constructs. Table 2 presents the correlations among constructs, with the square root of the AVE on the diagonal. The shared (correlation) between each pair of constructs was less than the average variance extracted (diagonal values), providing evidence of discriminant validity. Table 3 indicates the factor loadings.

5.5. Model evaluation

In the next step, the proposed structural model was estimated using AMOS (Arbuckle, 2006) for structural equation model (SEM) analysis (Fig. 4). Fig. 4 depicts all the significant SEM results in the research model. The SEM results showed a good fit between the data and the model for absolute fit measures (see Fig. 4): chi-square divided by degrees of freedom = 2.53 (≤ 3); NFI = .977 ($\geq .90$); CFI = .985 ($\geq .90$); GFI = .91 ($\geq .90$); RMSEA = .06 ($\leq .08$). The squared multiple correlations indicated the following results: perceived multimedia enjoyment: 36%; perceived learning: 43%. Table 4 presents the total effect, the indirect effects and direct effects and the hypothesis testing results.

As shown in Table 4, three paths were significant (perceived information needs → perceived multimedia enjoyment → perceived learning; innovativeness → perceived multimedia enjoyment → perceived learning; user preference → perceived multimedia enjoyment → perceived learning). The highest effect was obtained by the path starting with perceived information needs, second was the path starting with user preference and the lowest influence was found for the path starting with innovativeness. The new and cool trend construct was highly correlated to innovativeness, but did not influence perceived multimedia enjoyment or learning.

The questionnaire findings support the use of tablet technology. Before starting the training, 53.8% of the examinees evaluated the training supported by the tablet as an easy training program, 81.8% evaluated the training at the end as an easy program, 88.6% expected to receive a score of 8, 9 or higher out of 10 on the training exam, 69.7% indicated that they felt they learned more through the multimedia content than by self-learning. An interesting result was that about 50% of users preferred to learn alone and not in a social mode. The contribution of the multimedia content supported by the tablet was considered to be a way of enhancing knowledge: 47.2% (17.6% strongly agree, 12.6% agree, 14.3% neutral) of the users stated that they were able to better understand road safety rules and extend it to the current program, 77.5% (49.9% ranking highly satisfactory, and 28.6% ranking satisfactory) were highly satisfied or satisfied with the educational value of the program, 82.4% (51.1% ranking 5 highly satisfactory, 31.3% ranking satisfactory) of the users reported higher satisfaction from their learning with this program. In addition to perceived learning reported by users, the actual learning results tested by the license exam (see an example in Appendix II) showed that 40.7% responded correctly to all questions on the actual exam, 25.8% scored correctly on 75% of the exam, 26.4% scored correctly on 50% of the exam, 6% scored correctly on 25% of the exam, and 1.1% failed.

6. Discussion, conclusion and future research directions

In this field study, we used tablet technology in a road safety training program to present a series of digital videos about a group of young motorcyclists who meet in a garage and discuss real situations – such as accidents – and their outcomes. The videos incorporated real actors and simulation animations of specific situations, describing the cause and effect. An additional test was then provided at the end of the training to capture the objective knowledge of the participants. The proposed conceptual model was mostly supported by empirical data.

Table 2
Construct reliability and correlations.

Construct	Cronbach's alpha	AVE	AVE and squared correlations						
			PIN	I	PME	NC	PL	Up	
Perceived information needs (PIN)	.792	.62	.78						
Innovativeness (I)	.829	.63	.141	.79					
Perceived multimedia enjoyment (PME)	.792	.62	.512*	.193*	.78				
New and cool trends (NC)	.756	.67	.048	.537*	.091	.81			
Perceived learning (PL)	.748	.61	.552*	.068	.462*	.037	.78		
User preference (UP)	.808	.72	.326*	.129	.409*	.075	.471*	.84	

* $p < 0.01$.

AVE: Average Variance Extracted. Bold represent square root of AVE on the diagonal.

Table 3
Factor loadings.

	Perceived information needs (PIN)	Innovativeness (I)	New and cool trends (NC)	Perceived multimedia enjoyment (PME)	Perceived learning (PL)	User preference (UP)
PIN 1	.708					
PIN 2	.787					
PIN 3	.844					
PIN 4	.807					
I 1		.801				
I 2		.908				
I 3		.881				
NC 1			.819			
NC 2			.854			
NC 3			.787			
PME 1				.723		
PME 2				.724		
PME 3				.842		
PME 4				.847		
PL 1					.736	
PL 2					.802	
PL 3					.823	
PL 4					.785	
UP 1						.845
UP 2						.899
UP 3						.807
AVE	.62	.63	.67	.62	.61	.72

Note: the questions for each construct are listed in Appendix I.

We found those users' perceptions of their information needs, innovativeness and user preferences significantly impacted the learning outcomes from the mobile training, based on a multimedia program. Perceived multimedia enjoyment played a significant role in mediating these constructs with respect to learning outcomes.

The findings point to the following conclusions. First, information needs have a direct and indirect influence on perceived learning outcomes. Perceived multimedia enjoyment plays a prominent role in this process. Satisfying individual needs is important, but this study shows that information needs were supported by the multimedia content on the tablet, thus leading to higher learning. This may be interpreted in terms of the way perceived multimedia enjoyment turns the information need requirements to a more active situation, namely the information seeking process. Here, perceived multimedia enjoyment bridged the gap between theoretical learning and the real life applications of knowledge presented in multimedia training. The findings thus suggest that a multimedia learning environment can improve users' learning, and hence their performance (Bani-Salameh, Kabilan, & Bani-Salameh, 2011; Kim & Kim, 2012; Starbek, Starčić Erjavec, & Peklaj, 2010). Multimedia has been shown to be a popular instruction tool to present professional operating knowledge and skills (Sherin & Han, 2004) and the data here suggest that multimedia can also impact drivers' operating knowledge.

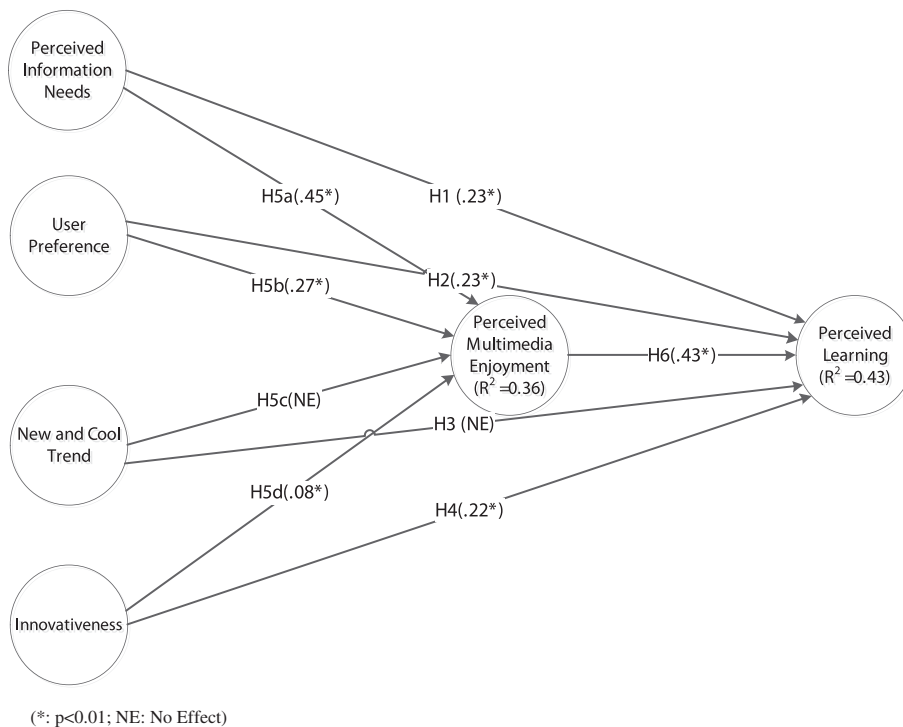


Fig. 4. Research model SEM results.

Table 4
Direct and indirect effects.

Path	Total effect	Direct effect	Indirect effect	Hypotheses
Perceived information needs → Perceived learning	.37	.23	.14	H1 supported
User preference → Perceived learning	.31	.23	.08	H2 supported
New and cool trends → Perceived Learning	NE	NE	NE	H3 Not supported
Innovativeness → Perceived Learning	.24	.22	.02	H4 supported
Perceived Information Needs → Perceived Multimedia Enjoyment	.45	.45	NE	H5a supported
User Preference → Perceived Multimedia Enjoyment	.27	.27	NE	H5b supported
New and Cool Trends → Perceived Multimedia Enjoyment	NE	NE	NE	H5c Not supported
Innovativeness → Perceived Multimedia Enjoyment	.08	.08	NE	H5d supported
Perceived Multimedia Enjoyment → Perceived Learning	.30	.30	NE	H6 supported

NE = No Effect.

All the other effects in the model were significant at $p < .01$ (*).

Second, this study highlights the importance of innovativeness in promoting effective learning directly and indirectly through multimedia content. Innovativeness was stimulated by the multimedia content, but the direct effect appeared to be a major contribution to learning outcomes. The novelty in the learning environment may have provided the impact, so that the "cool" factor was masked, and therefore no influence was found for learning outcomes, but rather a higher correlation with innovativeness. The implication of this result is important, since the young road users who took part in the training are attracted to new innovative technologies, and this is an opportunity to promote their learning on such a crucial subject.

Third, this study highlights the importance of user preferences to take the computerized training program through a tablet. A tablet's capability to present high quality multimedia is a factor that can attract young users to the road safety training program. Hence, more effort should be made in designing and implementing effective multimedia instructional materials on tablets to better engage Generation Y users and foster their innovative learning.

This study was carried out in an individual learning space; however, the literature suggests that mobile devices can create an active participation territory. This idea may be extended to develop a collaborative package, including collaboration with an expert in the field to support real time learning. Many educational practitioners have long believed that collaborative learning activities enable the exchange of thoughts, emotions, and ideas, among learners (Childress & Braswell, 2006).

Our research provides a range of contributions and implications for future research. As we were able to approach young road users and observe their usage of the tablet multimedia training in the field, our first contribution is to offer a better understanding of user learning in a mobile multimedia training context. We thus extend our current understanding of the usage of mobile devices for professional training. Our findings suggest that the presence and actions of other users; i.e., the famous actors playing in the multimedia film, provide a sense of being part of a community by the affordance of the tablets, which supports various cognitive, affective, personal integrative, social integrative, innovation and tension free needs.

Due to the nature of the field study, one obvious study design limitation is the absence of a control group. This was due to constraints on site. Notably, there was no electricity available in the field to charge the tablet training devices, so we could not set up traditional PC stations or laptops as a control group. In the past, the local road authority invested a considerable amount of its budget in preparing road safety training CDs and reading materials, which were not extensively used. Compared to the existing traditional road safety training, the tablet approach attracted many young users on site. Many were actively engaged in the tablet training, and they also asked the local road authority officials meaningful questions while taking the tablet training on site. In the future, if appropriate resources are available on site, we plan to conduct another field study to compare two distinct computer technologies for this training by incorporating more in-depth psychological and social factors to measure users' cognitive engagement. We also intend to expand our study, to better understand the user motivation and the cognitive absorption aspects of this tablet training program.

In order to measure the long-term effectiveness of this mobile training program, we plan to conduct a longitudinal study with those users who participated in the field study. With this in mind, we also aim to examine the effectiveness of a range of mobile technologies on training, such as mobile phones, as most users have personal mobile phones available. From a theoretical point of view, we will further explore how cognitive factors influence user learning with various mobile technologies.

We conclude that the affordances of tablets in providing training on the go intertwined with the specific needs of new young motorcycles drivers as a group in their particular stage of life, including self-experimentation, socializing and social learning. In the light of the high risks to new drivers, our findings indicate a novel way of training which might be further customized based on the learning characteristics of the individuals. We plan to enable a chat feature with an expert at the government center in future training. This has the potential to promote deeper learning and better user interaction experiences with mobile tablets.

Acknowledgements

We would like to thank the Computers & Education journal editor and two anonymous reviewers for their valuable comments and guidance to improve this paper. We also thank Mr. Ron Moskovich, Director of Israel National Road Safety Authority, and Dr. Shay Soffer, Chief Scientist at Israel National Road Safety Authority for their enormous help with this research project.

Appendix I

Perceived Information Needs (PIN)

1. This training provided me with the information I need

2. This training presented information about road safety which interested me
3. This training shared road safety information that can be of use
4. This training offered practical road safety lessons and tips, which were valuable

Innovativeness (I)

1. I like to learn about new ideas
2. I am interested in news stories that deal with new inventions or discoveries
3. I like to try new things before they come into fashion

New and Cool Trends (NC)

1. I like to try new stuff, because everybody else is doing it
2. I like to try new stuff, because it is the thing to do
3. I like to try new stuff, because it is cool

Perceived Multimedia Enjoyment (PME)

1. I enjoyed the multimedia features (e.g., videos) provided in this training
2. Multimedia elements (e.g., videos) in this training enhanced my understanding of road safety
3. The training provided me with a good opportunity to share my opinions with people
4. The training will enable useful social interactions in the future

User Preference (UP)

1. I prefer to use this system
2. I would recommend this system to my friends
3. I like this system better than other traditional systems

Perceived Learning (PL)

1. The training made me more aware of the importance of road safety
2. I learned useful road safety tips through the videos
3. I broadened my knowledge through the road safety training
4. I learned to value other points of view on road safety (e.g., the opinions put forward by experts in the movies)

Appendix II

Post learning outcome exam developed by professionals at the Ministry of Transportation

Sample content questions after viewing the “Riding Awareness” Features in the tablet training program:

- In the first feature, what kind of accident was the rider with the injured leg involved in?
 - A. Rear end collision
 - B. Collision with an inert object
 - C. Roll over
 - D. Side impact
 - E. None of the above
- According to the girl in the first feature (“Don’t Be Surprised”), what was the rider’s mistake?
 - A. Not yielding the right of way to a vehicle in the intersection
 - B. Speeding
 - C. Assuming that the driver would be aware of the oncoming rider
 - D. Improper braking
- In the second feature (“Caution – Traffic Violations”), what tip does the mechanic give to the rider approaching the intersection?
 - A. Before engaging in the intersection, stop and look in both directions and then proceed
 - B. Crossing the intersection – Slow down, look, establish eye contact with the driver (even if you have the right of way)
 - C. Enter the intersection with minimum acceleration, with both feet on touching the brake pedal, ready to stop or to evade
 - D. When approaching the intersection, look carefully all around to identify potential obstacles or dangers
 - E. All the answers are correct

- In the third feature (“Don’t Surprise Them”), what surprise is referred to?
 - A. Bursting into traffic
 - B. Two-wheeled vehicle rapidly changing its position on the road
 - C. Two-wheeled vehicle traveling on the road shoulders
 - D. Two-wheeled vehicle emergency braking
 - E. None of the above
- According to the features, how does the rider appear in the eyes of the car driver?
 - A. Stands out, large and fast
 - B. Small, fast and sometimes hard to see
 - C. Narrow, high and fast
 - D. All of the answers are correct
- According to the features, what is the significance of leaves on the road to the rider?
 - A. Additional friction on the road, therefore more stability
 - B. Esthetically pleasing, not adding or subtracting from road stability
 - C. Affects the grip of the vehicle’s tires on the road, therefore affecting stability
 - D. None of the answers is correct

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