Chapter

Interactive Multimedia Touch Screen Tablets and Gaming as a Vehicle That Fosters Learning Digital Skills

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Abstract

As digital multimedia devices further pervade the lives of everybody including the older adults, the need for relevant training for these age groups of people grows. Older adults, not due to their frailty or age, but because accessing and using digital devices like smart phones can be difficult for them due to a lack of digital skills required in use of multimedia devices, do experience the digital divide sharply. This paper intends to present the use of gaming on touch screen multimedia devices in learning digital skills for the elderly. The case study was carried out with a group of older adults in four European countries with multimedia tablets before they attended the training process for learning how to use smartphones. A parallel group was not exposed to the same devices and the tablet game playing. The comparative results from both groups have shown that gaming on multimedia devices improves the skills necessary for active use of digital skills in everyday life and foster their adoption.

Keywords: gaming, older adults, education, training, digital skills

1. Introduction

As nowadays digitalization is permeating all sectors and everyday life, citizens require more digital skills to participate in modern society, manage their lives and advance their professional careers. According to the factsheet of EU-based facts presented at the Digital Summit in 2017, 44% of the European population lacks even basic digital skills, although in the near future 9 out of 10 jobs will require digital competence. It is moreover predicted that in 2020 the Information and Communication Technology sector in Europe will face a lack of 500,000 experts. Despite the improvements in data and the clear commitment on the political side, Europe still lacks the digitally-skilled citizens needed to fill the gaps. In addition, the problem with the older adult population seems to be even more crucial as only 55% of individuals aged 65 or older use the Internet, according to investigations reporting on the developments in some European countries [1], while around 80% of the entire European population uses the Internet [2]. The importance of digital skills among older adults rose in parallel with the new Internet-based services, such as e-health and others, with the purpose of extending their stay at home before they need to move to retirement homes. The problem of missing digital skills among

older adults is related to the fact that older adults have no experience in using digital devices where the communication with the user most frequently uses an interface based on touchscreen technology. Among these devices, of major importance for older adults is the use of smartphones for social communication but also for the tasks of their everyday life. It is a well-known fact that social inclusion with the help of modern communication technology strengthens social contacts and reduces loneliness [3]. The problem of learning digital skills among older adults come from the way they have learned in their youth and from the feeling that they are outsiders to the digital culture. Older European adult citizens may either be retired or middle-aged, and they often lack the skills required to use the services accessible with modern smartphones or similar devices with touchscreen interfaces. Digital skills are increasingly required for performing instrumental tasks such as searching for contacts, medical help, measuring medical indicators in e-health services or paying bills, and taking part in democratic processes. To use them, older adults often visit public day centers where they can find assistance to perform even simple tasks. In EU 63% of the population is accessing internet via mobile phones and as a part of the access is the use of Digital Public services that are becoming important source of data, support and help. Measured by dimension indicators they show growth in 2017 in most of the EU countries, where Austria is among the leading, followed by Slovenia and UK [4].

In Europe, several initiatives were undertaken for overcoming this problem. Among them is the European Cooperation for innovation and the exchange of good practices dedicated to establishing cooperation between educations to exchange skill practices. The recently launched action known as Skill Agenda contains several initiatives that seek to improve the digital skills at all levels and among all citizens, with specific focus on older adults. One of the active projects that address the education for learning digital skills is the project GIRDA Gameplay foR Inspiring Digital Adoption from the ERASMUS+ program.

The work presented in this paper is aimed to provide another aspect and approach of learning digital skills by older adults by focusing on older adults with no prior experience with digital technology. These were offered game-playing on large tablets with touchscreen interfaces offering multi-media experience and touch screen use. The gaming was applied as an entertaining lessons prior the course for learning how to use smartphone.

This chapter provides an overview of the results and findings from the exploratory study carried out by the GIRDA partners. The focus of the study was on the use of an alternative learning approach expecting this to facilitate the adoption of digital literacy by older adults. At the same time, the study tried to find the underlying reasons for the older people's low pace in the adoption of the necessary digital skills and to prepare some guidelines for the mentors or instructors helping the learners in their effort to learn. The learning games offered to the groups of older adults were selected based on the different skills needed in game-playing. The study was carried out in four European countries, the UK, Austria, Slovenia and Macedonia, and the results were collected from 107 adults aged between 57 and 84, later elaborated, studied and compared. The country selection was based on the percentage of aged population in particular country and the portion of aged that used internet. UK and Austria have relatively high portion population with digital skills above basic e.g. 42% in UK and 35% in Austria. Slovenia portion of population is 27% and in Macedonia the number is even smaller (13%) [4]. The percentage of population of adults over 65 years in the EU population is between 16 and 18% in most of the EU countries, but the portion of this population that uses internet differ very much among the selected countries, from 63% in AT and UK, 43% in Slovenia and 21% in Macedonia.

The chapter briefly introduces the theoretical background of the research, the research setting, and the presentation of the findings accompanied by discussion and conclusion.

2. Theoretical background

A literature review on gaming by Connolly and co-workers [5] shows that different academic papers deal with the benefits of playing digital games, and that game-based learning "is used across many curricular areas, most notably in health, business, and social issues". It was found as well that the interest in games within a learning context is based on motivational reasons. Games seem to be "motivating and enjoyable" for the players. On the other hand, playing games can coincide with learning. This is true especially if the learnability property of the game is high [6]. Studies have found that cognitive abilities (knowledge creation, organization, and application) are mainly related to games that present solvable problems and challenges when used for obtaining a specific learning outcome. They are usually designed to be adaptable to the skills and the level of the learner's knowledge. The game-learning components associated with technical or motor skills are related to the game's attributes, known as the learner's participation and interaction, learner engagement, control and navigation [7]. Motivation has positive relations concerning the game's attributes that specify the goals and rules of the game, its fantasy component and the provision of specific feedback to the learner. Given the positive effects of gaming, older adults are considered a "great potential to accept" digital game-based learning [8].

Kaufmann also describes the motivational aspects and other additional benefits for older adults who play digital games, including the "mental experience", "dealing with loneliness or depression" or "developing confidence" [5]. Since playing digital games "does not require specific skills" [9], learners can start playing at a low competence level and can "gradually accumulate other types of skills while improving their gaming skills. However, the reported studies did not examine the effects of digital games on acquiring digital skills beyond the self-reporting of participants. The study presented below explored the effects of playing games on touchscreen tablets on the performance in using a smartphone after completing a training workshop, compared to another group of older adults without game experience in gaming on a touchscreen device.

Rather than testing existing assumptions about the behavior of older adults when facing digital technology, the decision was made to apply the Grounded theory as the theoretical background. According to several authors this theory is ideal for exploring integral social relationships and the behavior of a group of people where little exploration of the contextual factors that affect individual's lives are known. The Grounded Theory [10, 11] developed by Martin and Glaser in late 1970s enables exploratory studies to resolve different research questions, but equally importantly it allows to generate issues and questions during the ongoing investigation that may be answered after the experiment. The approach enables the simultaneous collection and analysis of data, the creation of analytic codes and categories developed from data without pre-existing conceptualizations. The theoretical sensitivity of the methods enables discovery of the basic social processes within the data, theoretical sampling to refine categories and writing analytical memos as the stage between coding and writing the integration of categories into a theoretical framework. The initial approach of the study was to look at categories related to the behavior of older adults toward digital technology, for example the emotions expressed by the participants during and after the gaming experiment. The type of the positive emotions that was supposed to formulate the categories was

the pleasure when playing the game, increase in satisfaction and social interactions as the game-playing was conducted in pairs of older adults and among of a group from the same environment. The developed positive emotions were also expected to reduce the fear of older adults toward digital technology. It was planned data to be generated by coding the videotapes, by analyzing the post-experiment surveys, the processing of the questionnaire and by use of the data collected through the interviews carried out after the gaming sessions. The main research questions to be answered were:

a. Are there any issues or difficulties in learning and training digital skills for older adults when exposed to multimedia touch screen device that are specific for that group of learners?

b. Will older adults show positive emotions toward gaming?

c. Does population of older adults display any difference toward the adoption of digital technology depending on the local environment and the country where they live?

d. Do the skills acquired during gaming foster the adoption of digital skills required for access to digital services by smartphone devices or have other effects?

e. Is the training in smartphone use and the effectiveness in task performance influenced by the skills acquired by playing games on a touchscreen tablet?

f. Will older adults change their resistance toward digital technology?

National survey data from EU member states shows [12] that older non-users are not willing to explain their behavior and lack of interest in modern digital technology. This position is not necessarily straightforward as the lack of interest may obscure some other underlying lack. That was the reason why the approach of the Grounded theory was used to collect data from the interviews, and the questionnaire was expected to provide some insight into this issue.

The most commonly used methods recommended by the authors and practitioners of this theory are interviews based on open-ended questions that can be modified during the ongoing research. The second method is an observation of the focus group by deriving the coding and identifying the issues. Then an analytical method is used to analyze the collected data from the open coding analysis and the interviews with participants [11].

3. The study design

3.1 The experiment setting

The study design was based on two study phases: experiments with focus groups of older adults who played games, and the training courses for smartphone device use that followed after the playing sessions. In the second experiment, the participants were divided in two groups, a group that played games for 45 minutes before the course started compared to the second group that took the same training course but did not play games before the training course. Several games were used as a learning tool for developing and practicing skills critical for using touchscreen technology, for example, to tap, drag, rotate objects on the screen and moving

objects. Besides the game properties known to enable the development of cognitive and motor skills along with participation and interaction, some additional criteria were considered when selecting the games, such as the familiarity from the 'real world' (card games, crossword puzzles and jigsaw puzzles, chess, and backgammon). Regarding the previous knowledge of the participants, the study team decided to select participants without any skills in playing games on touchscreen devices and with no knowledge or practice in using computers.

The study was designed as two-player games on a touch-table device (basically giant tablets, e.g. the Lenovo table, see **Figure 1**). The introduction to touchscreen functionality for older adult learners was made in an immersive low-pressure environment within a group from the same environment where the fact that participants were learning was actually 'hidden'. Older adults were invited to an "entertainment session". The Lenovo touch table used in the study offered a selection of pre-installed games that can support up from one to four people playing simultaneously. However, it was decided that the games would be played by pairs of older adults of the same gender or mixed genders and, if possible, from the same environment. Exploring the diverse range of game categories available on a Windows touchscreen device presented certain challenges to the study group as the wrong selection could be off-putting for new users trying to find their way in using the screen functionality. Another important criterion in game selection was the game to create [13] a non-stressful, enjoyable path to learning cognitive and acquiring motor skills. This implied game types that do not present a too heavy cognitive burden for the learner, as this usually distracts from the skill-learning process. The same applies to games with a complex set of rules that may burden the player's working memory. Popular games on the market were found to be overly sophisticated; 'educational' games are aimed at pre-school and primary school age children, while 'adult games' were found to be inappropriate for this type of experiment. More useful were the genres which included puzzles, board games, and casual games.

The decision was made that the first game to be introduced to the participants should use a basic drag action as an introductory lesson for using a touchscreen device. The drawing game was selected first as the most appropriate for users who had no experience with touchscreen technology or any other type of computer games before. The simple drawing tool in the game repertoire was selected as an introductory element so that the participants could have a first experience of just touching the tablet and getting an immediate visual result – be it a fingerprint-sized dot, a line, a house or a ship. The drawing game allows users to change the color using the tablet keys. The second game introduced the rotate action and the moving of objects on the screen; this was a puzzle game that requires from the players to complete the image. Puzzles are popular entertaining games, and the idea was that

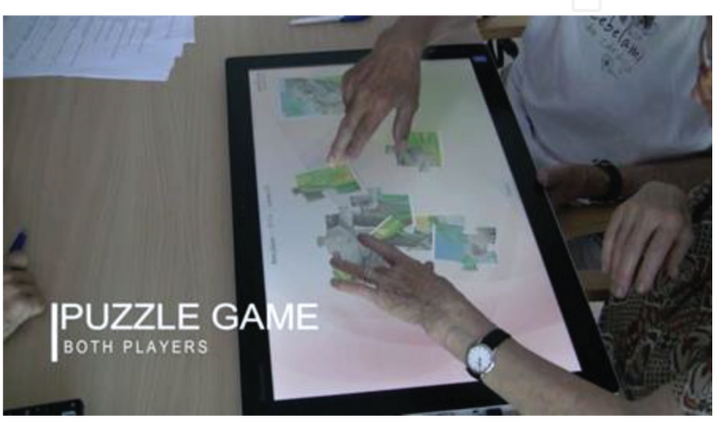


Figure 1.
The puzzle game.

not much explanation would be needed for playing a simple puzzle game. However, this game enabled learning other skills, moving, rotating in dragging objects to come into the right position to assemble the image. The third game was selected from the list of games with in-situ judgment, such as the very popular heavy-traffic road crossing game known as Crossy Road. Another game selected was the Candy Crush game. In Crossy Road the player is moving an object across very busy roads, while trying to prevent the object from being crushed under fast-moving vehicles. If the crash happens before the object can reach the other side of the last road, the game closes and starts again. This game focuses on coordination of the vision/recognition and motor activity of the player fingers. The Candy Crush game involves very short distance drag actions similar to the Crossy Road game. The actions often cause rapid system responses that are out of proportion with the input actions. This rapidity undermines the second participant's ability to observe and take in the active user's behavior. The pace of action is similar to the Crossy Road game. The selected games proved to be useful in identifying the key variations and their pros and cons of learning how to act on a tablet's touchscreen. The second phase of the experiment focused on the two groups of older adults who have enrolled in a training course for learning how to use a smartphone. The experiment was carried out in cooperation with Simbioza Genesis institution which maintains an inter-generation center in Ljubljana. Over the course of 5 years, they have connected more than 15,000 older adults and 9000 young people from all over Slovenia in a pan-Slovenian campaign of computer and Internet literacy [14]. In the last 2 years, Simbioza has developed a model for teaching older adults how to use a smartphone. Other countries participating in the experiment have set up similar cooperation with institution working with elderly e.g. in UK that was the Good Things Foundation which is responsible for managing the UK Online Centers Network for older adults with over 5000 community centers and a learning platform known under the name My Way, which supports over 2 million people. In Austria that was the Association for Older Adults in Upper Austria, in Slovenia and Macedonia cooperation was set up retirement homes. One half of the smartphone course participants were offered to play the same games as in the first experiment for 45 minutes on the Lenovo big tablet each day before they started the lessons that were spread over 1 month twice a week. At the end of the course each attendee was asked to answer the questionnaire which included the same questions as for groups of older adults in the first phase of the experiment; then they were asked to perform five different tasks specified by the mentors on the smartphone. The tasks are presented below. The same tasks were given to both participating groups - the group that had no experience in playing games on tablets and the second group that played games before the lessons in smartphone use.

The tasks were as follows

1. We would like you to apply for financial social assistance to the on-line Social Service. You do not know how to do it, so you need first to contact the Social Work Center. Find the appropriate public service to find a contact through the web.

2. The course mentor sent you as enroller a reminder about the terms of the course. You have found out that you will not be able to come at some of the course specified terms. Write an SMS as an apology to the mentor.

3. You have many interesting pictures in your phone's gallery. We would like you to send some of them as Multimedia Messages e.g. videos or photos of your close relatives. Open the gallery or photo/video application and select file you prefer to be sent and send it to the specified telephone number.

4. You would like to borrow a book from a nearby library. You need to know the address of the library so that you know how to go and reach the library. Find the address of the library closest unit in your area of living.

5. Today is Wednesday, and on Friday you would like to go on a trip to the neighboring hills or touristic spot. It worries you that the weather will be bad. Find a forecast for Friday by using the application on your smartphone.

3.2 The demography

The age of the participants ranged from 57 to 87. Most of them had no previous experiences with digital technology, as for the experiment novices were requested to form the groups. The level of participant's education ranged from high school up to the master's degree. Some of the participants had weaknesses in some of their motor abilities, and this governed the way data were collected after each of the completed sessions. The learners played the game in pairs. They were expected to collaborate in helping each other – a socializing effect enriched by the other members of the particular group present during the experiment. The presence of witnesses, i.e. friends interested in the gaming, is usually considered a key dynamic of co-learning. Participants take clues from watching the partner interact with the system and the consequent system response. One of the study tasks was to observe how people interacted with each other as well as with the technology, and how the choice of game or activity influenced the changes in these interactions.

In the UK, the participants were selected with assistance with Good Things Foundation. The emphasis for the UK team was to involve in the experiment older people close to retirement, or post-retirement, from socially deprived areas. Most of the UK participants (40 persons) were from the west of England, Stockport, while the other selected group came from the London area with the help from a local group supporting isolated women (20 persons). The participants in the Slovenian part of the study were recruited from three retirement homes in Ljubljana, Slovenia (Bokalce, DEOS Črnuče and Kolezija (30 persons)) and from two other retirement homes in the Velenje region in the north-eastern part of Slovenia, also retired people (30 persons). The Austrian participants were selected with assistance from the Association for Older Adults in Upper Austria (26 persons). The Macedonian and Slovenian team approached retirement homes that involved group of 60 persons in each of the countries that took part in the experiments. The groups of older adults who attended the smartphone training course consisted of 30 people aged from 55 to 75 years. Both genders were present, 18 men and 12 women; both groups had little or no prior experience with touchscreens. The first group was asked to play games on the giant touchscreen tablets with the same selection of games as in the first experiment, for 45 minutes before the training course started; the second group entered directly to the training lessons in smartphone use without contact with the gaming tablet.

4. Data collection and analysis

4.1 First part of the experiment

Video recording was made of each session for each group in the four European countries. The videos were analyzed with an aim to examine the problems encountered by older adults in maneuvering on the touchscreen and the cases of required help and support from the facilitators. After each session, the participants in each of

the groups that took part in the experiment were asked one by one to take part in an interview with the facilitators and the members of the study group. They were also asked to complete the questionnaire with the same number of questions. The questions were developed according to guidelines for qualitative research in psychology.

The analysis that followed was based on the coding generated from the videos focused on finding answers and information about potential obstacles for building digital skills. Identification of the specific needs of older adults in learning and adopting digital technology was one of the objectives of the carried analysis. In addition, an input in developing mentor guidelines to support the learning of older adults was sought. Examples that illustrate this approach can be summarized as: do the participants experienced any difficulties in applying the motoric skills necessary to act on the touch screen, how strong was the players' immersion in the games (obtained from the facilitator's observation), was collaboration among the pairs present and was it seen as a support in solving the game. The analysis of the video data presented in Appendix A with one coding example from the experiment carried out in Slovenia showed that the learning hindrances experienced by the participants could be summarized as three types of actions required by the participants:

- Request for support from the mentor in cases when the game appeared to be locked,
- Support/help provided by the mentor in cases the touch screen did not reacted to the participant move, and
- A request for help from the gaming partner.

These actions usually followed a failure of motor control over the tablet and in cases of errors, such as the change of color, fixing the tablet in the expected position or re-activating the game in case of failure. In the case of Candy Crush and Crossy Road errors, the request for support most frequently happened when the participant misunderstood the rules of the game. However, in playing the whole set of games, supportive activities among the pairs and the witnessing members of the group were noticed as well as several examples of progress acknowledged by the accompanying persons. Both independent and cooperative activities were noticed as well as enjoyment and engagement in the game playing. The qualitative uses of the post-test interviews were meant to provide information about the emotions the participants felt [15]. The data collected from the conversation with each participant indicate that most of them (82%) described the action as pleasant and full of fun. However 18% found the gaming somehow tiresome. The most enjoyed game was the puzzle, followed by the drawing game. Crossy Road was somehow tiresome for some of them and maybe demanding due to the required speed of action and coordination of vision, cognition of the scene and the motor skills required for successful playing. Most of them (75%) said that they do not find the use of the touchscreen difficult; the other part (25%) declared that they had encountered some difficulties especially in the Crossy Road and Candy Crush games due to the speed required in moving the object. An important finding was that most of them (95%) did not experience any physical discomfort in using their fingers to play the games. The same results were obtained from the assessment of the feelings experienced and developed toward the novelty of the technology used and the attraction of playing games on a touchscreen table. Most of the participants did not find that playing games was difficult (80%) and the attractiveness of the approach was also assessed as high (90% of the participants agreed that the gaming was attractive).

The participants declared that they would describe this experience to others as fun and good entertainment. The collaboration – playing as a pair and with group support was also accepted positively by most of the participants.

The collected data from the post-test questionnaire was analyzed further with the similar aim as with the interviews: to reveal how older adults react and accept the new digital touchscreen technology, do they accept gaming as a way for learning and if is a fear from technology still present when they are faced with the use of digital devices after the experiment with the touchscreen gaming. Selections of processed data from all involved countries are presented in Appendix B and the sample of the coding of videos on Appendix A. The answers to the fifth question that asked if the participants had any fear in facing the touchscreen are not presented as the participants reported that no fear was felt at all. In general, the entire experiment was assessed by the participants as a very positive experience. Some participants asked will there be a second session with the same technology and the same facilitators. One of the main finding from the study was that the older adults from different countries regarding the level of digital technology use by elderly expressed very common attitudes e.g. No fear and readiness to learn through gaming and having fun was declared by the participants. The answers about the enjoyment they experienced when playing games were distributed between „strongly agree "and „agree "with the fun provided with the gaming. The Macedonian group responded with only „strongly agree "answer to this question. The same observation was found for the second answer from the questionnaire „ I have learned something about using a touch screen" which confirmed by majority of the participants. The statement "I would be interested in playing more games" got the highest positive answers in the UK and Macedonia (only "strongly agree" and "agree"). The answers from participants in Austria and Slovenia were more dispersed, however highest number of positive answers were still given to "strongly agree" and "agree." The statement „I now feel more positive about using digital systems after this "was approved in all four countries with the answers "strongly agree" and "agree." The chart from these data is presented in Appendix B. As a summary of the collected and analyzed data, it can be stated that older adults have developed positive emotions toward playing computer games on a large touch screen tablet.

4.2 The second part of the experiment

The data collected by measuring the timing and the success in performing each of the five tasks (specified in Section 3.1.) The members of the two groups of older adults who attended the one-month training course showed remarkable differences in the performance of the specified tasks. Both groups were smaller as there were 16 learners; each group consisted of 8 learners. The members of the first group played the same games on the same tablets as the learners in the first part of the experiment. The playing was arranged before the lessons for use of smartphone. This group displayed much more performance and skill in completing the complex tasks specified in Section 3.1 after the course was finished. The tasks were completed correctly by the group one learners, the required results/information specified in the tasks were obtained, and the timing for completing the task was much shorter compared to the timing required for tasks competition in the other group that did not played games. The first and the fifth tasks were simple and the differences in the efficiency of performing the tasks by the particular learner from both groups did not differ very much. The average timing for the members of both groups was close to 1 minute (0.58) for the first task and 0.3 minutes (0.23) for the fifth one. However, the differences among the timings of the more complex tasks, e.g. the task no. 2, 3 and 4 were remarkable. The average timing for task 2 was

1.196 minutes for the group that practiced gaming and 3.471 for the other group that did not payed games, task 3 required for successful task completion by the gaming group 1.178 minutes and in 2.272 minutes by the group without gaming experience, and task 4 required 0.492 minute for the gaming group and 1.16 minute for the control group. This gaming group performed the task no. 2 three times faster, the task no. 3 twice faster, and the task no. 4 1.4-times faster. This gaming group was interviewed as well and asked to answer the same questions in the questionnaire as the older adults participating in the first experiment. The collected data give additional positive insights about the role of game playing on touchscreen tablets for the adoption of digital skills by older adults.

5. Discussion

In most cases, the foundations of being a good user, meaning to develop trust, self-efficacy and perceived value, is growing slowly and steadily without anyone giving the matter much thought, often well before someone, for example a child, starts learning in a particular case. By the time the person is 17, s/he can easily understand the benefit of learning to drive as this helps the mobility. The person is also well aware of the risks of driving but also knows how they can be mitigated.

However, these learning foundations are often absent when it comes to non-users of digital technology, as several studies [3] proved that is very hard to teach them using the general 'show and tell' system. The first step – going from being a complete non-user to an engaged newbie – is the steepest process in the new digital area according to Häikiö [15], The challenge for digital inclusion practitioners is to ensure that the training for new users is fun, social and risk-free, while still building vital interface skills and encouraging experimentation and self-guided learning by the learner. Research shows that these factors are especially important for older learners, for whom the opportunity to play with digital technology helps to capture interest and build confidence [16]. These findings were confirmed in the presented study as well. However, some specific issues were noticed too.

In the studied sessions and the observation found in the described experiments show that almost all participants adopted the touch interaction method easily regardless of their motor skills. Evidence from the experiments presented above suggests also that the 'right' game depends on a number of factors, and that perhaps in this type of learning the mentors or facilitators would benefit from a diagnostic tool that will provide guidance in selecting games based on players' attitudes, skill levels and relationships with their partners. Most of the participants in the above studies understood the games easily, and some outperformed the others especially in playing the second game – the Koala puzzle. All of them were capable of drawing a figure on the tablet and changing colors; however, several trials were necessary to touch the right place on the screen and perform the right move. The differences in the flow observed among the participants might be attributed to the fact that the players with some motor weaknesses seemed to encounter more problems when interacting with the Crossy Road game (see **Figure 2**), as the game requires fast reactions with the finger. Immersion in the game was present as well. Collaboration among the players, coming both from the partner in the pair or from the group that gave loud advice how to act on the tablet, was very noticeable and in general it was supportive. Some of the participants were first watching before they actively entered the game. Observations during the sessions suggested that the cognitive load of managing the session sometimes required more than one facilitator. Altogether these findings came from the participants' observations, but also from the data collected from the interviews and the closed questionnaire. Despite the

age-related cognitive and physical changes, all participants were able to play and to understand the questions in the questionnaire. More research regarding the test criteria, such as the reliability and internal consistency of the study, seems to be necessary especially when further learning is in place, like for example in the second part of the experiment with smartphone use courses.

The coding of the video clips from the playing sessions revealed the problems older adults face when they try to use the digital touchscreen technology for the first time. The facilitator and partners usually provided support after a learner sought help. Depending on the problem, they usually decided to use explanation, demonstration or instruction as support methods. Questioning as a method for helping people to continue the task was used also several times by the facilitator. The analysis of the video tapes has shown that the given support was not always correct, and this points to the need for experienced facilitators and good guidelines or a specially developed manual. However, overall supportive activities in most cases were appropriate, and the participants were usually able to continue the task successfully. The same problem re-occurred quite often after the facilitator's support and help was sought again, but the majority of the participants did not give up the gaming and they continued to play.

The analysis of these situations identified the following issues that need consideration:

- Failure in motor control
- Expected encouragement from the facilitator – the need for support
- Co-learning by the playing partners was expected but not always requested

These issues point out clearly that for older adults to adopt digital technology, but it is obvious that more attention should be provided by the facilitators who are supporting the learning or training of older adults. These people also need more information about the needs of older adults and instructions about how to solve problems that appear from the low motor skills and sometimes with the lower cognition capability or vision capacity of the learners. Their support should be given in the form of explaining, demonstrating, and instructing. Cooperation and social interaction by friends or family were found to be equally important [17]. These findings provide answers to the first research question. Yes, older adults need additional attention in preparing the environment and in terms of support during educational sessions dedicated to the adoption of digital skills.

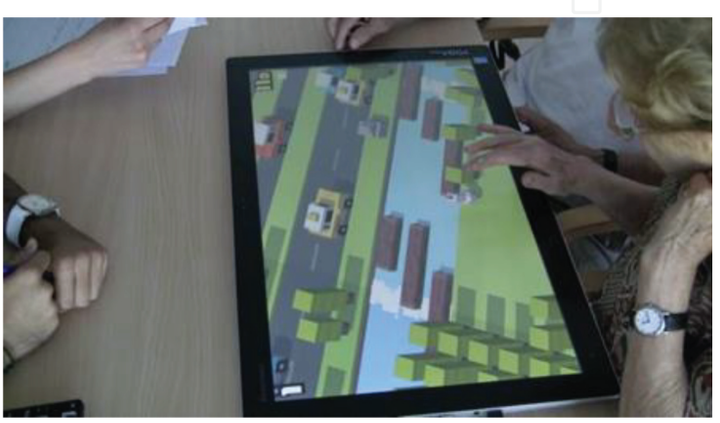


Figure 2.
The Crossy Road game.

The interviews with the participants in both parts of the experiment have shown that acceptance of new digital systems is not a problematic issue for older adults. However, there were obstacles when an explanation how to handle some game hint was not immediately provided to the players by the support team. The coding of video tapes has revealed the problem. Some participants were afraid to make mistakes or to fail when using the devices and hesitated to act when the other person in the plying pair faced a problem. Social influence was welcomed, but it expected to be positive and helpful in the training. The accomplishment of the game also appeared to be more important for older people than a low effort as was found also by AlMahmud et al. [18] . These findings give a positive answer to the second research question: In our experiments, older adults have shown positive emotions toward gaming.

The answers to the questions in the questionnaire further confirmed the findings from the video tape analysis. Selections of the processed data from all countries involved in the experiment are presented in Appendix B. In general, the entire experiment was assessed by the participants as a very positive experience. Some participants asked will there be a second session with the same technology and the same facilitators. The charts in Appendix B show that the older adults from the countries studied have very common and similar attitudes toward new challenges and the possibility to learn through gaming and having fun as no big differences were found. The results from the second experiment served to find the answers to the research questions (d) and (e). The more efficient performance of the tasks displayed by the members of the gaming group clearly has shown that playing games could be a very useful tool in facilitating the training of digital skills for older adults for using of smartphones. Fun experiences during game-playing clearly help in faster and more successful learning to use a digital device which leads to faster adoption as well. The reported fun older adults had when playing games contributes to the development of positive emotions toward digital technology as this approach helps in removing fear from not being able to participate in modern society.

6. Concluding remarks

It is well known that to become a proficient user of anything, some absolute essentials are needed. Each person needs easy and regular access to the thing/device to be used, as s/he needs to develop the skills required for the effective use of it. But having that access and learning those skills are not of much use if there is no trust in the items that are used, and if the user does not have faith in his/her abilities to use them, or simply does not see the point. Just like any other skill, these internal conditions are not innate, and there are many factors that influence the degree to which someone possesses them and likes them, as they can be nurtured and grown with the right kind of support. The big difference from the classical teaching of digital inclusion is that games on touchscreen tablets can be very appealing, entertaining and incredibly easy to learn. In the case of the training of older adults, they need to be accommodated in order to for answer to the elderly specific needs. In fact, the easier and more familiar they are, the better for the elderly learner, at least to begin with. The rules for learning this type of games are not the rules of the game itself or for winning the game, but the rules of how to interact with a digital device. However, we can state here that the value of the approach in learning digital skills for older adults was confirmed by the presented experiment where gaming was used as a pre-learning activity in the smartphone use course for older adults. The group that played games before the course has shown a remarkably better efficiency in performing the more complex tasks required for interacting with digital services with use of a smartphone. This additionally implies that the gaming approach for

older adults by means of touchscreen tablets needs to be further developed with approaches that accommodate the learning to the elderly specific needs. This applies especially for the process when mentors, facilitators or other persons involved select the most appropriate game that enables to equally practice both motor and cognitive skills. Playing and learning as a social activity is another dimension that should be further supported in learning digital skills by elderly, as the presented experiments have shown. A clear notice about the progress in learning digital skills by applying playing games as entertaining activity appeared to be an important property of the strategy applied in enhancing the learning of digital skills for older adults.

The study presented has some limitations and the source of this is the selection and the number of participants. It was envisaged that the number of participants from each country should be 60, which would make a total sum of 240 people. However, the final number was lower due to the difficulties in attracting relevant participants by the focus group that carried the experiments. So the total number was lower. Another limitation was the social status of the participant and the level of education that was not questioned. The only request followed was the lack of any experience in work with computers or similar technology. Further studies similar to the one presented in this paper are needed for more evidence to be collected for provision of e more complete answers to the research questions addressing the inclusion of elderly in the digital society and the erasing the digital divide between the young and the old.

It can be claimed that the study carried out in the context of the Gameplay for Inspiring Digital Adoption (GIRDA) project has considered most of the aspects of modern learning of digital technology by elderly. Older adults need to know how to use modern devices such as smartphones, to stay socialized and to enjoy the advantages of modern technology specially designed to help them when aging or to enable stay and live at home as long as possible. Many e-health applications nowadays are developed for older adults but their use and the benefits they bring depend on the users' digital skills and the understanding of the service offered. Playing games on a touchscreen table is obviously one of the methods to help them to acquire these skills more easily and in a friendly manner. Learning without knowing that the person learns is simply more acceptable as it is an easy way to adopt what is needed in the present and future digital world. However, further studies can contribute more the digital divide to become more noticeable. The future rounds of data collection by additional experiments and analysis should be aimed on the understanding of the optimum setup for this kind of r learning, and to the selection of games that will yield the best results. We hope that in future there will be opportunities to use this evidence to create tailor-made games that can develop the touch screen interface skills and help older learners to overcome the lack of confidence and a feeling that using touchscreen computers is risky and complicated.

However, the presented study provided some implication for the practice that can be summarized in the following recommendations:

- Teaching practices examples from the study about how to respond appropriately to older adult computer issues.

- Putting time and effort into selecting the best facilitators is vital to building good working relationships between older adults, facilitators, and staff.

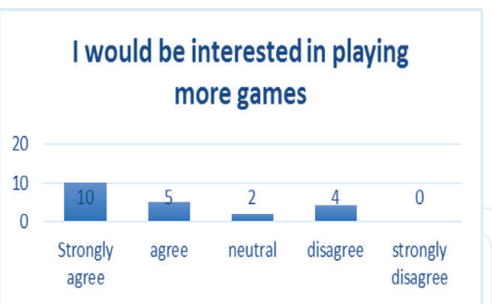
- Reassuring older adults that they are progressing with often complex computer software applications is a vital strategy in encouraging them to persist with learning and training the digital skills.

A. Coding sample from the drawing game video tape

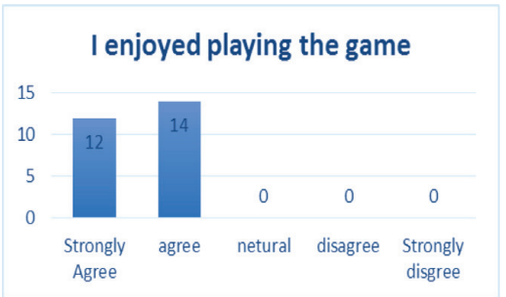
Issue/problems	Frequency	Description
Methods of motor control	2	Most of the learners used the index finger of the right hand for drawing and tapping.
		Learner switches between the index finger of the right hand and the thumb of the left hand (06_720,00:06:48)
Failure of motor control	3	Problems appeared in color changes as the learners did not use the exact button on the Lenovo tablet. Swiping the toolbar not possible.
		Learner tries to swipe but cannot activate the button (12_710, 00:03:02) (10_720, 00:05:01),
		• Tapping not exact enough.
		Learner wants to choose a color but does not tap exactly enough so it does not work (10_700, 00:05:11)
		Learner uses the fingernail for drawing; no results were produced (10_710, 00:03:16)
Errors	2	This issue is triggered by different reasons which are all related to the usage of the tablet:

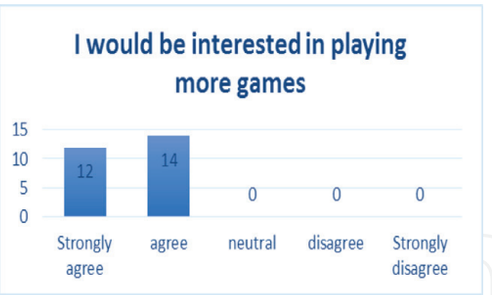
B. Data from the post-experiment questionnaire

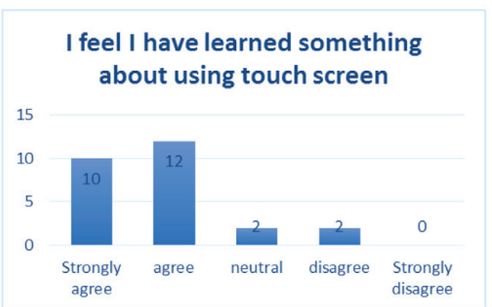
B.1 Austria data

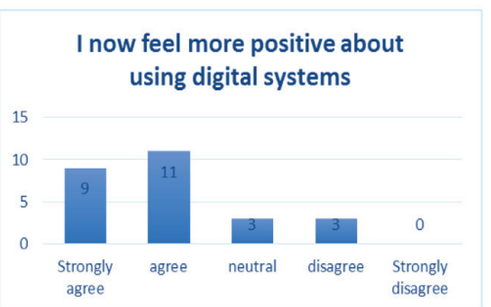


B.2 United Kingdom data

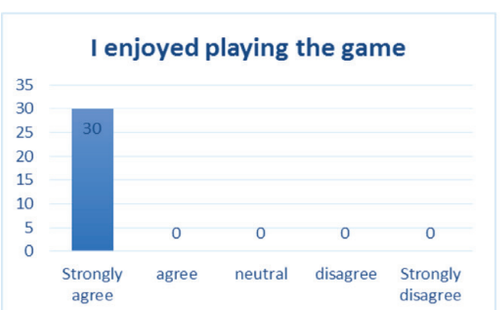


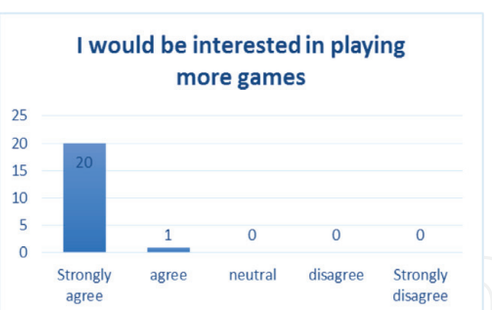


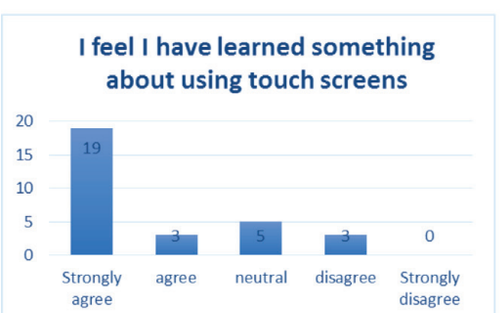


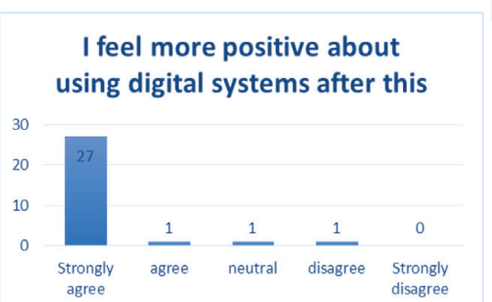


B.3 FYR Macedonia data

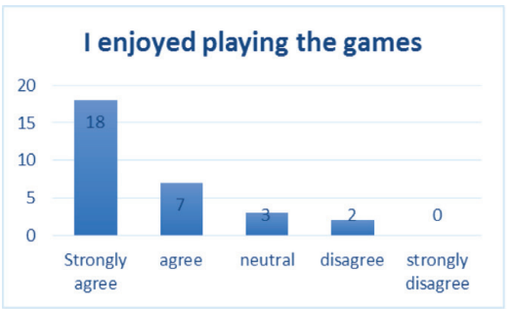


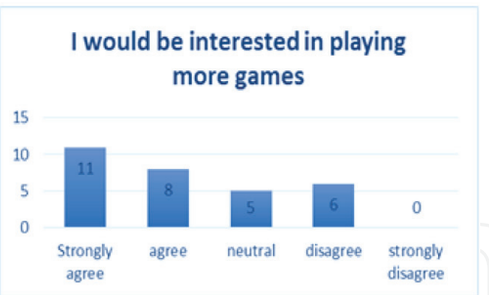


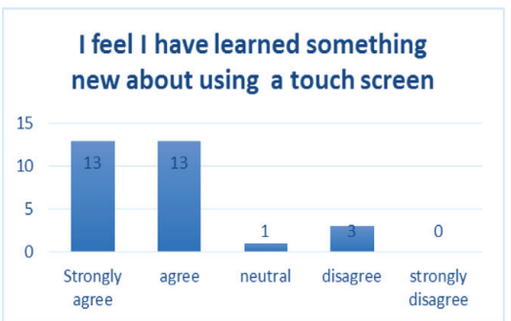


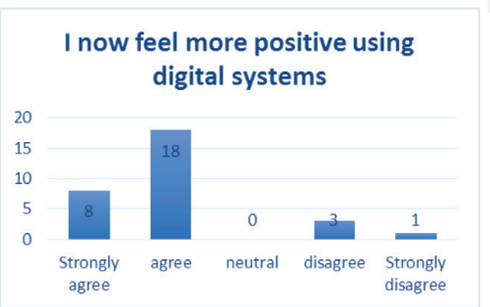


B.4 Slovenia data









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