prisma social
revista de ciencias sociales
Revista de Investigación Social
ISSN: 1989-3469

Nº 15 | Diciembre 2015 - Mayo 2016 – Tecnologías Móviles en la Educación y Sociedad Actual
pp. 415-439 || Sección Temática
Recibido: 1/10/2015 – Aceptado: 19/11/2015

A COMPARATIVE ANALYSIS OF USING TWO MOBILE TOUCH DEVICES (IPAD ® AND IPHONE ®) BY AN ADOLESCENT WITH DOWN SYNDROME

A case study in an outdoor context

Sofia Reis
Department of Communication and Art, University of Aveiro, Portugal

Ana Margarida Pisco Almeida
Department of Communication and Art, University of Aveiro, Portugal

UN ANÁLISIS COMPARATIVO DE USO DOS DISPOSITIVOS TÁCTILES MÓVILES (IPAD ® Y IPHONE ®) POR UN ADOLESCENTE CON SÍNDROME DE DOWN

Un estudio de caso en un contexto informal

RESUMEN

En este artículo se presenta un análisis comparativo de uso de dos dispositivos móviles táctiles (una tableta y uno *smartphone*) por un adolescente con síndrome de Down, en un entorno de aprendizaje informal. Los dispositivos utilizados son suportados por un mismo sistema operativo iOS (iPad® y iPhone®). Con este estudio de caso queríamos saber qué dispositivo funciona de manera más eficaz en términos de interacción, manejo y portabilidad, teniendo en cuenta las características del participante y un contexto de aprendizaje informal. Para los efectos del análisis comparativo, se desarrollaron cuatro actividades en un contexto *outdoor*, implicando el uso de un dispositivo de maiores dimensiones (iPad®) y uno de dimensiones menores (iPhone®). Las actividades se llevaron a cabo en dos sesiones y fueran video grabadas en su totalidad para posterior análisis de contenido. Los resultados obtenidos indican que no hay diferencias significativas en la interacción con los dispositivos escaneados. Sin embargo, el *smartphone* se a revelado ser más versátil, en termos de portabilidad y manejo, perante el contexto elegido, teniendo en cuenta las respuestas dadas por el participante.

ABSTRACT

This article presents a comparative analysis of using two mobile touch devices (a tablet and a smartphone) by an adolescent boy with Down syndrome in an informal learning environment. The devices were supported by iOS operating system (iPad® and iPhone®). With this case study we wanted to know which device works more effectively in terms of interaction, handling and portability, considering both the participant characteristics and an informal learning context. For the purposes of the comparative analysis, four activities were developed in an outdoor context involving a larger mobile touch device (iPad®) and a smaller one (iPhone®). The activities were held in two sessions and video recorded for later content analysis. The results obtained indicate no significant differences in the interaction with the scanned devices. However, the smartphone revealed to be more versatile, in view of its portability and handling, which was evident in the outdoor context, considering the responses given by the participant.

Palabras clave

Dispositivos móviles táctiles; tabletas; iPad®; iPhone®; aprendizaje móvil; contextos de aprendizaje informal; Síndrome de Down.

Keywords

Mobile touch devices; tablets; iPad®; iPhone®; mobile learning; informal learning contexts; Down Syndrome.

1. Introduction

We live in a markedly technological era and, as such, we cannot ignore the presence of various personal technological devices in our daily lives, particularly mobile devices. With touch interface features these equipments totally mark the technological profile of today's society. With easy connectivity and friendly portability, these devices provide greater ubiquity to learning, allowing its extension to different contexts, whether formal, non-formal or informal (Naismith et al.,2004). In fact, tablets and smartphones allow young people to establish permanent links both with the school and with their daily routines, contributing to shorten the gap between formal and informal learning.

The massive use of multiple technological gadgets has brought into public discussion the topic of using these devices in an educational context (Valente & Gomes, 2015). Many government policies have supported the discussion on "mobile learning", giving place to the implementation of projects that promotes tablets and smartphones use in schools (Thompson, 2013). Portugal, like its European partners, has followed this trend by investing in some pilot studies for the last few years, particulary in the field of tablets, mainly those related to the "European Schoolnet" (Balanskat, 2013). Despite this investment, there is scarce research focusing on the use of this technology in populations with special needs, even though the UNESCO's report (UNESCO, 2013) allusive to the topic of mobile learning recognizes its potential. As Clarke & Svanaes (2014:1) point out "Ubiquitous access to technology is recognised by UNESCO as facilitating the more personalised learning, benefiting especially children with learning difficulties."

Until now, there has been scarce research on using tablets in the context of special educational needs (Pellerin, 2012; Ramos et al., 2012; Campigotto et al., 2013; Dionne, 2013; Flewitt et al., 2014). Some studies were conducted mostly among children and youth with autism spectrum disorders (Mintz et al.,2012; Mintz, 2013; Ayres et al., 2013; O'Malley, Lewis & Donehower, 2013). Likewise, non-formal and informal learning contexts, still lack deeper investigations, particularly among individuals with Down Syndrome (DS). It is known that these contexts are essential to develop functional skills being those determinant for full participation of this particular vulnerable group in their daily community life. Nowadays, the specificity of this genetic condition it is well known, as the individual with DS goes through the same stages of development than their peers with a tipical development, though at a slower pace. Some research into the DS emphasize the use of convencional technology (computer and perifericals) to support their learning processes (Tanenhaus, 1991; Almeida, 2006; Feng et al, 2008; Feng et al, 2010). In the study conducted by Almeida (2006) with 13 children with DS, the usability of some technological devices (touch-screen, mouse and track-ball) was tested. The results suggests that a greater number of tasks were performed without any help (80%) when using touch screens. The participants were able to deal with this equipment with greater ease and authonomy, giving clear indicators that this kind of touch screens equipment could be an effective solution among these group. At the time of this study tablets and smartphones were far of being available on the market; a decade later, mobile devices stand several features that enhance its use in inclusive settings: touch screen, intuitive interface, portability, tool immersion (such as camera and microphone), flexibility in presentation of text and image, easy connection to the Internet, multiplicity free apps targeted for SEN (Dunn, 2012). Among the most commonly used tablets, the iPad® has been point out as a potentially useful teaching tool in the field of special education, since their use may increase or improve the functional capabilities of students with special needs (Valstad & Rydland, 2010).

With a similar structure, tablets and smartphones compete in terms of weight, size and price (Valente & Gomes, 2015), converging, however, in the gestural paradigm. The use of gestures has gradually replaced or complemented the traditional peripheral input, particulary mouse and keyboard. Commonly referred to as "touch gestures", these are performed by the user by means of the movements of the fingers on the screens of different devices that support this kind of technology, each time more massive in today's mobile devices. This trend has driven the major companies in the technology industry to strongly invest in touch features, designing in its genesis different libraries of gestures, which are associated to the operating systems that they patent, namely: iOS (Apple); Windows (Microsoft); Android (Google); Fire OS (Amazon); Blackberry OS (Blackberry).

Since the devices analised in this study are related to the iOS operating system we have considered the main gestures associated with the user's interaction with the iPad® and iPhone®.

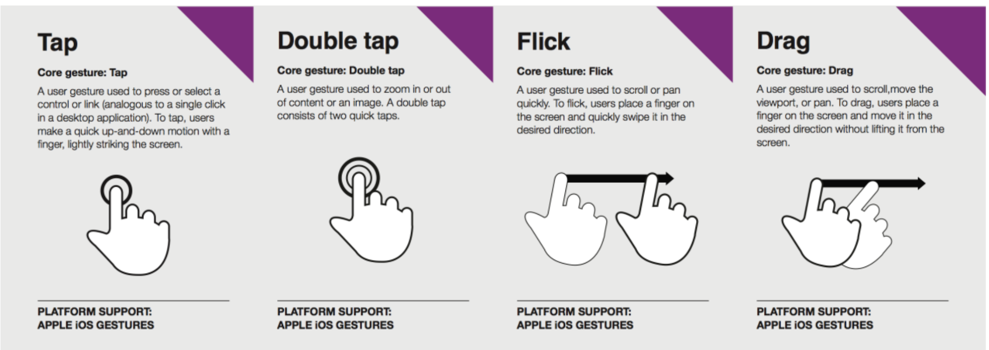

Illustration 1 - Touch Gesture Cards (retrived from Luke Wroblewski et al., 2011.

2. Objectives

The objective of this comparative study is to understand how a teenage boy with Down Syndrome uses mobile touch devices considering aspects such as interaction, handling and portability in order to ponder the most effective device to support him in daily functional activities. Indeed, in a preliminary study conducted in the context of this research, there were some remaining doubts about the device that could best respond to the participant's needs. To reach that knowledge, we decided to go for a comparative analysis of using two mobile touch interface devices (iPad® and iPhone®)..

3. Methodology

In terms of methodological options, this case study assumes an exploratory and descriptive nature, since brings together techniques and instruments for data collection and analysis that fall into a qualitative approach. As point out Yin (2010) in a case study it is necessary to deal with multiple sources of evidence - interviews, direct and indirect observations, video records, documentation analysis - in order to gather, in detail, a large number of information.

For this comparative analysis, four activities were outlined and implemented in two sessions. To ensure accuracy of data collection, sessions were video recorded, in order to collect information with, as much detail as possible, since a direct observation, *per se*, would hardly extend. To record the video, we had the collaboration of a fellow researcher, also from the school relations of the participant, hoping that his presence would not constitute a distraction or inhibition factor to participant's performance. That became an assertive decision.

The collected data resulted in eight videos subsequently housed in the WebQda qualitative analysis software. To facilitate data analysis, every excerpt recorded on video was transcribed and encoded. Technical problems related to the video display in this analysis software led us to complement video data with written information (textual description of each video). According to Bardin (2009), content analysis uses the categorical analysis as a technique, which is aimed to analyze the content and expression of content through an encoding process. In fact, the detail arising from the transcript of these sessions allowed us to distinguish units of analysis that resulted in a categorization of the collected data which were confined in three analysis dimensions, supporting an ideographic perspective, since the final categorization resulted of a complementation of *a posteriori* analysis.

The defined dimensions are as follow.

a) Dimension I – Interaction with the touch mobile device (iPad® and iPhone®). Several aspects were considered: i) the most frequently used gestures to develop each task; ii) the most commonly used fingers to do the interaction with the device; iii) the number of actions involved for executing each task; iiii) the overall capacity of execution for each task. The presented tasks involved actions such as: 1) Turn on the device; 2) Unlock the device; 3) Access to specific applications, 4) Use the chosen APPs; 5) Exit the APPs. Since some of these tasks involved the use of the virtual keyboard, the written component was also observed and analyzed in aspects such as the accuracy of touch in the virtual buttons (effective or ineffective touch) or the number of touches associated with the writing task (upper, lower or equal to the number of typed characters).

b) Dimension II – Handling the device (iPad® and iPhone®). In this dimension, we considered actions such as: i) remove the device from backpack ii) hold the device, iii) manipulate (rotate) the device; iv) storing the device.

Dimension III – Portability of the device (iPad® and iPhone®). In this dimension, we focused on the capacity of carrying the device for a short period of time, the capacity of carrying the device for a longer period of time, and the comfort of carrying the devices in moments of mobility and non-mobility.

4. Description of the study

Developed between September and October of 2014, this comparative analysis had the participation of a teenage boy (aged 15) with a genetic condition (Down Syndrome). Regarding the characteristics of the case, we present an illustrative table of its functionality in terms of his technological profile. The collected data has resulted from a semi-structured interview applied to the participant's mother at a preliminary stage. This interview was designed in order to obtain information about the conventional technology and emergent technology used by the participant in topics such as: technology used, competencies of use, constraints of use and intention of use, as shown below:

Table 1 – Technological profile of the participant

USED TECHNOLOGY	COMPETENCES OF USE	CONSTRAINTS OF USE	INTENTION OF USE
LAPTOP COMPUTER	The participant uses the laptop with complete autonomy in actions such as: – searching the Internet – listening to music – watching youtube videos – accessing, talking and sharing files on Facebook	– he likes to explore different computer programs on his own (sometimes some go wrong, other times they go well) – Invents a bit because he is a bit on its own – he enjoys having his privacy when he is on Facebook (invert the screen)	• to search the web • to listen to music • to watch videos • to chat on Facebook
CELLPHONE (his own)	The participant uses his phone with relative autonomy in actions such as: – listening to music – taking pictures – sending messages	– he has difficulties in managing the balance of his mobile phone (spends the credit limit so it is loaded)	• to listen to music • to take pictures • to text
PLAYSTATION	The participant uses the Playstation with complete autonomy to: – play games	– Elimination of games in a (in) voluntary way (the remaining doubt is if the elimination of programs is purposeful or not)	• to play games with siblings • to play games alone
MP3	The participant uses MP3 with relative autonomy to: – listen to music	– Difficulties in keeping phones (spoils the earphones a lot because he has difficulties in managing the length of the wires)	• to listen to music with and without earphones
TV	The participant uses the TV and the command with complete autonomy in actions such as: – accessing programs; – recording TV programs;	– Difficulties in understanding the limits of the use of the TV set – Manages the TV command by trial and error in order to know the functions of all buttons)	• to watch TV programs • to record programs of his choice • to manipulate the command buttons
TELEPHONE	The participant uses the landline telephone at home with complete autonomy in	– Difficulty in managing the timing (sometimes the	• to talk with family and friends

	actions such as: – keeping in touch with relatives and friends	family needs to hide the equipment, due to the insistence of using it for a specific person: every time he wants and whenever he wants to)	
SMARTPHONE (parents)	The participant sometimes uses his father's smartphone. He uses the gestural paradigm to access and play games, apparently without difficulty, and with some autonomy.	– Constraints are not pointed out in the interaction with the device (despite sometimes calling the last people linked to the father's mobile phone)	• To entertain himself

Overall the participant has several skills related to handling different technological equipment namely: computer and its peripherals (mouse and keyboard), landline phone, cellphone, portable playstation and MP3, TV and remote control (to see programs' schedule and to record programs).

It is noteworthy that during the preliminary study there was no touch interface equipment in the participant's home, except for the parents' smartphone, with which the participant occasionally interacted, mostly for entertainment purposes. At this investigative stage, a tablet was introduced in the family context. The comparative study that is now being described happened ten months after the introduction of this new equipment at the participant's home.

It should also be noted that, for reasons related to the safety and the prevention of accidents resulting from the use of these devices in outdoor context (that somehow could demobilize the participant to proceed with the poposed activities), we anticipated the integration of two elements that could facilitate the portability of the devices. In the case of the iPad®, we integrated a protective cover with an adjoining handle. In the case of the iPhone®, a 50 cm strip was integrated.

Illustration 2 – Protective cover with an adjoining handle

Illustration 3 – Protective cover with a 50 cm strip

Despite this procedure, we noted that the integration of these elements didn't require any obligation of using it during the participant's performance.

In order to achieve the objectives stated above, two sessions were specified. These were developed in an informal learning context (a city park close to the place where the participant lives). The choice for an outdoor environment was related to the variety of offer in terms of entertainment and leisure activities and the variety of scenarios favorable to the purposes of the comparative study. The fact of being a public setting allowed us to exclude some of the constraints we had felt during the preliminary study and which were related to the video recording authorization needed in private and enclosed spaces.

Thus, for the Park scenario, the four basic activities were presented, alternately in two separate sessions (September 19 and October 3, 2014). The temporal *décalage* between the first and the second session was related to restrictions of the participant's school schedule and unfavorable weather conditions. These factors contributed to the delay of the second session, forcing the temporal distance between the two sessions.

To avoid the transference of knowledge resulting from the handling of either device, it was decided to alternate the use of the devices to carry out the activities. However, an exclusion criteria was pre considered since the interdependence of the following activities: ATVc-S1; ATVd- S1; ATVc-S2; ATVd- S2. In that particular case, the same device was used, not considering the switching criteria.

For a better organization of the data, the activities have first been identified with the ATV nomenclature, followed by the first four letters of the alphabet (a, b, c, d) and the session number (S1 and S2), as set forth in the following table:

Table 2 – Activities Codification

SESSION 1 – 19-09-2014			SESSION 2 – 03-10-2014		
ACTIVITY	**DESCRIPTION**	**DEVICE**	**ACTIVITY**	**DESCRIPTION**	**DEVICE**
ATVa-S1	Using the Maps APP	iPad®	ATVa-S2	Using the Maps APP	iPhone®
ATVb-S1	Using the Calculator APP	iPhone®	ATVb-S2	Using the Calculator APP	iPad®
ATVc-S1	Using the Camera APP	iPad®	ATVc-S2	Using the Camera APP	iPhone®
ATVd- S1	Using the Mail APP	iPad®	ATVd- S2	Using the Message APP	iPhone®

5. Collected Data

Once the data was entered on the qualitative analysis software, the registration units were encoded in order to facilitate the triangulation and subsequent interpretation of the collected data. Table 3 presents the adopted abbreviations used in order to facilitate the reading of the obtained matrices.

Table 3 – Matrices code abbreviations

Description	Abbreviation
not applicable	(N/A)
not observed	(N/O)
index finger of the left hand	(IFLH)
index finger of the right hand	(IFRH)
thumb finger of the right hand	(TFRH)
thumb finger of the left hand	(TFLH)
effective touch	ET
ineffective touch	IT
number of touch equals the number of characters	No. T=No. C
number of touches lower the number of a characters	No. T<No. C
number of touches higher the number of a characters	No. T>No. C
without help complete autonomy	(WHCA)
without help some autonomy	(WHSA)
left hand	LH
right hand	RH
Less	-
More	+

The following table (4) reports one example of the four matrices that have resulted from the collected data related with the implemented activities, identified previously in table 2. To abbreviate the presentation of the collected data, in this paper we only present the example of one matrix which explores the three dimensions considered for analysis: Dimension I – Interaction with the touch mobile device; Dimension II – Handling the device; Dimension III – Portability of the device.

Matrix's example – iPad® Vs iPhone® – Maps APP

Table 4 – Matrix's example – Using APP Maps on iPad and iPhone

Dimension I – Interaction with the touch mobile device – Task 1 – Turn on the device			
iPad		iPhone	
Gesture used	N/A	Gesture used	N/A
Finger used	IFLH	Finger used	TFLH
No. of touches	1	No. of touches	1
Execution capacity	WHCA	Execution capacity	WHCA
Dimension I – Interaction with the touch mobile device – Task 2 – Unlock the device			
iPad		iPhone	
Gesture used	DRAG	Gesture used	N/O
Finger used	IFLH	Finger used	N/O
No. of touches	1	No. of touches	N/O
Execution capacity	WHCA	Execution capacity	N/O
Dimension I – Interaction with the touch mobile device – Task 3 – Access to MAPS APP			
iPad		iPhone	
Gesture used	TAP	Gesture used	FLICK+TAP
Finger used	IFLH	Finger used	TFRH
No. of touches	1	No. of touches	1+1
Execution capacity	WHCA	Execution capacity	WHCA
Dimension I – Interaction with the touch mobile device – Task 4 – Use the MAPS APP			
iPad		iPhone	
Writing task associated	YES	Writing task associated	YES
Number of write events	1	Number of write events	2
Touch precision on virtual keyboard	Effective touch	Touch precision on virtual keyboard	1ºineffective 2ºeffective
Number of touches made	No.=carat	Number of touches made	3+No.<carat
Fingers used on the virtual keyboard	IFLH	Fingers used on the virtual keyboard	IFLH+THRH
Gesture(s) used	TAP	Gesture(s) used	FLICK+TAP
Dimension I – Interaction with the touch mobile device – Task 4 – Exit the MAPS APP			
iPad		iPhone	
Gesture used	N/A	Gesture used	N/A
Finger used	IFLH	Finger used	IFLH
No. of touches	1	No. of touches	1
Execution capacity	WHCA	Execution capacity	WHCA
DIMENSION II – Handling the device			
iPad		iPhone	
Remove device from backpack	YES	Remove device from backpack	NO
Hold the device	HANDLED	Hold the device	STRIP

Manipulate (rotate) the device	LH	Manipulate (rotate) the device	RH
Store the device	BACKPACK	Store the device	NO
Ocorrencies using adjoined handled	1	Ocorrencies using the adjoined strip	1
DIMENSION III – Portability of the device			
iPad		iPhone	
Transport the device for a short period using...	HANDLED	Transport the device for a short period using...	STRIP+LH
Transport the device for a long period using...	BACKPACK	Transport the device for a long period using...	STRIP
Comfort of using the device in mobility mode	-	Comfort of using the device in mobility mode	
Comfort of using the device in non-mobility mode	N/A	Comfort of using the device in non-mobility mode	N/A

6. Data analysis and discussion

The collected data allowed us to discuss and better understand the potential that iPad® and iPhone® devices can have, considering the three dimensions designed for this comparative study (interaction, handling and portability).

In the interaction with the mobile touch devices (iPad® *vs* iPhone®) – our first dimension – we found no significant differences in the interaction of a larger size device or in a smaller size device, contradicting the idea that we had when we started this investigation. In fact, our first perception based on the literature review on the topic of mobile devices (Valstad & Rydland, 2010), (Melhuish & Falloon, 2010), which motivated us to use a tablet in the preliminary study, suggests that a larger device could be a facilitator in the interaction, both in terms of understanding screen icons, search boxes, virtual keyboard, taking into account the physical characteristics of the equipment versus the morphological and anatomical characteristics of the participant of this study. However, with this comparative analysis, we noticed that the participant showed the same easiness of use and interaction with the smaller device (iPhone®), most often activating the smartphone in the first interaction with only one touch.

The anatomical features of the participant's fingers (shorter and thicker), has not proved to be an impediment. The participant used mainly his index fingers of both right and left hands and both thumbs to interact with the small device. Likewise, the activation and unlock processes of the device were successfully achieved mostly on the first touch. In tasks involving the writing mode we also observed dexterity to use the virtual keyboard, either with the larger device or with the smaller, producing most of the touches efficiently and with complete autonomy. In one of the observed records related to the interaction with the iPhone®, using the virtual keyboard, the participant produced Tap gestures for the most part. He successfully made the alternate use of the thumbs of the right and left hands while he held the device simultaneously. Also, the participant used the index finger, either of the right or the left hand, to comply similar actions in other occurrences. In three of the four observed occurrences related to writing activities, the number of Taps produced on the virtual keyboard was equal to the number of typed characters. At one time, the number of Taps produced was inferior to the number of characters required for writing the text, since the participant took the text predictor function to complete the task, with complete initiative and autonomy. In this regard, the skill level to complete the tasks that involved interaction with the virtual keyboard was similar in both devices and there is no significant disparity in the use of these two devices.

Overall the icons activation related to the used applications were completed without major difficulties. Once, and on his own initiative, the participant used the "search" field to find the Maps icon, not selected during the first icons exploitation on the smartphone layout.

Regarding the second dimension - handling the devices (iPad® and iPhone®) - other actions were considered, such as removing the device from backpack, hold the device, manipulate (rotate) the device, perform tasks, and storing the device.

In this dimension, the main differences were naturally related to the size of both devices. Indeed, in the case of the larger device (iPad®), the participant chose to use the backpack to store this equipment in moments associated to larger distances in space and where he would no longer need to use the device while walking. There were no constraints related to placing the device inside the backpack or even removing it from the backpack. In both cases he showed complete autonomy to complete these actions. Sometimes he appealed to the existing handle on the back of the device to remove it from the backpack. The same support (the handle) was used on a recurring basis in actions such as holding the device to develop tasks in a situation of non-mobility, although it has also been observed using the device without the handle, in the latter scenario. In this situation, the participant chose to put the iPad® on the table, using it as a support in order to continue the interaction with the device. When moving in space for a short period of time, there was a greater use of this resource (handle), revealing comfort in the transportation of this equipment.

As regards the smaller device, the participant chose to make use of the strip integrated in the device, placing it in suspension on his neck. This was observed more in tasks that involved mobility in the space, although he also opted for this solution in times when the task did not involve any movement at all.

In situations where the participant remained standing, along with the use of the strip as a support device, we also observed that the participant chose to hold the device only with his hands, making greater use of the left hand to grab the device while the interaction proceeded with the gestures of his right hand. There were also moments in which the participant chose to interact with the device by placing it on the table top. On these occasions, he alternated the use of the fingers of both hands to interact with the equipment.

On what the third dimension is concerned, the devices portability, the use of two solutions to assist portability of both devices seems useful to carry the equipment in outdoor environments, since it contributed to build the participant's confidence in using it. Thus, to transport the larger device (iPad®) for shorter periods, the participant chose to carry the equipment in his right hand for most of the time, making use of the existing grip on the back of the device, holding it as a palette. To carry the device in larger distances, the participant chose to put the equipment into the backpack. The comfort of using the mobile touch devices was also considered in this study. According to the collected data, the participant found comfort in using the handle as a support to transport the larger device for shorter periods. However we also observed some constraints in using the correct positioning of the hand between the handle and the device. On the one hand it was necessary to help the participant with correct the placement of the handle. On the other hand, the option to put the device inside the backpack, at times when distances were larger, demonstrated lack of transport functionality and practicality in terms of the transportation of this equipment in the described situations.

Concerning the smaller device (iPhone®), the participant chose to carry the device suspended on his neck for most of the time, using the strap attached as a device support. Alternatively, he used both hands to hold and carry it. There wasn't any attempt to put the device in the pocket of his pants, though when we asked him where he could put it, he referred to this possibility, as well as the backpack pocket, despite never having used to these two options during this exploratory study.

7. Conclusions

The uniqueness of this comparative study turns it difficult to generalize the obtained data; however, as states Stake (2009) the real aim of a case study is particularization, not generalization. In this perspective, the gathered results allow us to state that, at this particular context, the suitability of the smaller device (iPhone®) to develop the activities presented (outdoor environment) seems evident. Indeed, the participant of this study showed greater comfort in using the smartphone in tasks that involved mobility in space, having a better coexistence with this device in the selected environment. In this regard, the smaller device allowed more discretion, while the larger device brought other concerns related to its size, motivating the participant to keep the iPad® in the backpack several times, particularly in times when the distances in space were larger. In fact, the exposure to the larger device itself leads us to consider its confined use in outdoor settings for issues related to portability and security, since it is as an addition focus of attention, due the features of its size. In this perspective, a tablet with the same dimensional characteristics used in this study may be more volatile to the activities developed in outdoor environment. In contrast, the ease of use present in smartphones is better suited to this type of activities. For that reason, the choice of a particular device over another must necessarily comply with the idiosyncrasies of each individual and the environment in which it will be used and should be framed in accordance with the purposes of its use. Thus, a *tablet* can be more versatile in performing tasks developed in more formal contexts of learning, as it allows greater interaction and participation among peers, given the size of the screen. In turn, a smartphone can be more appealing and less intrusive in fulfilling tasks of informal learning environments, such as those presented in this study.

Although the existing literature in the field of Special Educational Needs (SEN) is not abundant, the results are seen as promising as seen in the SenNet report (SENnet, 2014), which mentions several benefits, including those related to the accessibility issues, such as VoiceOver, Zoom and Large Font, White and Black Display, Closed Captioning and Mono Audio or Voice Control (Dunn, 2012). In fact, these devices are currently identified by some authors as the most assistive technology, since its use is generalized to the entire population and it is not confined to a particular group of individuals, which contributes to reducing stigma related to SEN people, who now have the opportunity to handle the same devices that their peers use (Schaffhauser, 2013).

The results presented in this paper were fundamental to support the continuity of a larger research project that frames this study in which we want to specify the proof of concept of an APP, specifically designed for the context of mobile devices. This APP aims to assist young people with Down Sindrome (DS) in actions related to the financial management associated to their daily events. We focus on the topic of financial literacy among this population since it is one of the least explored in literature for people with this genetic condition (Faragher, 2014). We believe that these devices with the right personalized scenarios and resources can improve the financial literacy of these individuals in order to become more independent and proactive in the community where they operate.

8. References

Almeida, A. M. (2006). "Tecnologias da comunicação nos sujeitos com défice cognitivo: as especificações dos utilizadores e os processos de flexibilização e adaptação do acesso, uso e participação em ambientes distribuídos de comunicação e aprendizagem." Tese de Doutoramento não publicada, Departamento de Comunicação e Arte, Universidade de Aveiro. Disponível em: http://biblioteca.sinbad.ua.pt/Teses/2010001351

Ayres, K. Mechling, L. Sansosti, F. (2013). "The use of mobile technologies to assist with life skills/independence of students with moderate/severe intellectual disability and/or autism spectrum disorders: considerations for the future of school psychology." Psychology in the Schools 50(3):259-271.

Balanskat, A. (2013). "Introdução de Tablets nas escolas: Avaliação do Projeto-Piloto de Tablets Acer." European Schoolnet, Bruxelas, Bélgica.

Bardin, L. (2009). Análise de conteúdo. Lisboa: Edições 70, Lda.

Campigotto, R., McEwen, R., Demmans Epp, C. (2013). "Especially social: Exploring the use of an iOS application in special needs classrooms." Computers & Education 60:74–86.

Clarke, B., Svanaes, S. (2014). Tablets for Schools: An Update Literature Review on the Use of Tablets in Education, pp.1.

Dionne, C. (2013). "An Introduction to Mobile Apps for K-12 Students with Special Needs: An Instructional Website for Educational Technology Students." ETEC 690: Spring.

Dunn, J. (2012). "The 200 Best Special Education Apps." Edudemic. URL: http://www.edudemic.com/special-ed-apps/

Faragher, R. (2014). "Learning mathematics in the secondary school. Possibilities for students with Down Syndrome." pp. 174-191 in Educating Learners with Down Syndrome: Research, theory, and practice with children and adolescentes. 1st ed. New York, Routledge.

Feng, J., Lazar, J., Kumin, L., Ozok, A. (2008). "Computer Usage by Young Individuals with Down Syndrome: An Exploratory Study." ASSETS08, October 13-15, 2008, Halifax, Nova Scotia, Canada.

Feng, J., Lazar, J., Kumin, L., Ozok, A. (2010) "Computer Usage by Children with Down Syndrome: Challenges and Future Research." ACM Transactions on Accessible Computing, Vol. 2, No. 3, Article 13.

Fernández-López, A., Rodríguez-Fórtiz, M., Rodríguez-Almendros, M., Martínez-Segura, M. (2013). "Mobile learning technology based on iOS devices to support students with special education needs." Computers & Education 61:77–90.

Flewitt, R., Kucirkova, N., Messer, D. (2014). "Touching the virtual, touching the real: iPads and enabling literacy for students experiencing disability." Australian Journal of Language and Literacy, Vol. 37, No. 2.

Melhuish, M., Falloon, G. (2010). "Looking to the future: M-learning with the iPad." Computers in New Zealand Schools, 22(3):1-16.

Mintz, J., Branch, C., March, C., Lerman, S. (2012). "Key factors mediating the use of a mobile technology tool designed to develop social and life skills in children with Autistic Spectrum Disorders." Computers & Education 58:53–62.

Mintz, J. (2013). "Additional key factors mediating the use of a mobile technology tool designed to develop social and life skills in children with Autism Spectrum Disorders: Evaluation of the 2nd HANDS prototype." Computers & Education 63:17–27.

Naismith, L., Lonsdale, P., Vavoula, G., Sharples, M. (2004). Literature review in mobile technologies and learning. FutureLab Report, 11.

O´Malley, P., Lewis, M., Donehower, C. (2013). "Using Tablet Computers as Instructional Tools to Increase Task Completion by Students with Autism." Kennedy Krieger Institute. Paper presented at 2013 American Educational Research Association Annual Meeting in San Francisco, CA.

Pellerin, M. (2012). "E-Inclusion in Early French Immersion Classrooms: Using Digital Technologies to Support Inclusive Practices that Meet the Needs of All Learners." Canadian Journal of Education, 36:44-70.

Ramos, A., Ferreira, S., Reis, S. (2012). "Análise das potencialidades do iPad® visualizadas nos vídeos do YouTubeTM no âmbito das Necessidades Educativas Especiais." Internet Latent Corpus Journal, 2(2):5-18.

Schaffhauser, D. (2013). Assistive Technology goes Mainstream, the journal, Vol.40, N.5

SENnet (2014). Tablets computers and learners with special educational needs, SENnet project thematic, report 3.

Stake, R. (2009). A arte da investigação com estudos de caso. Lisboa. Ed. Fundação Calouste Gulbenkian.

Tanenhaus, J. (1991). "Home-based computers programs for children with Down Syndrome." New York: National Down Syndrome society.

Thompson, V. (2013). Literature Review – Evidence of impact of 1:1 access to tablet computers in the classroom.

UNESCO (2013). Policy guidelines for mobile learning. Paris: United Nations Educational, Scientific and Cultural Organization, pp.42-43.

Valente, L., Gomes, M.J. (2015). Tablets use in schools, Instituto de Educação, Universidade do Minho, pp.9.

Valstad, H., Rydland, T. (2010). "iPad as a pedagogical device." Norwegian University of Science and Technology.

Wroblewski, L., Villamor, C., Willis, D. (2011). Touch Gesture Cards. http://www.lukew.com/ff/entry.asp?1071

Yin, R. (2010). Estudo de Caso: Planeamento e métodos. Porto Alegre: Bookman.