Peer-reviewed paper

The iPad as a mobile assistive technology device

Linda Chmiliar and Carrie Anton

Dr Linda Chmiliar is Associate Professor of Inclusive Education at the Athabasca University, Athabasca, Canada. Carrie Anton is Assistive Technologist at the Athabasca University, Edmonton, Canada.

Abstract

Purpose – *The purpose of this paper is to present the viewpoint of the authors on the use of the iPad as an assistive technology tool for post-secondary students with disabilities.*

Design/methodology/approach – *Although this paper is not classified as a research article, the viewpoints discussed by the authors are related to a pilot study and continuing case study research they are conducting.*

Findings – *The authors indicate that they have been surprised at the positive results they have observed in the iPad implementation, particularly with students moving to the iPad to continue their studies at the completion of the research.*

Practical implications – *This paper discusses the opportunities and limitations afforded by the use of the iPad with post-secondary students as well as suggestions for implementation.*

Social implications – *After decades of experience in the field of assistive technology, the authors are becoming convinced that the iPad offers significant opportunities for learning for students with disabilities. One of the exciting parts of being involved in these iPad studies has been to observe: the transformation of student study skills, the increased student self-discovery around how they learn, and the increase in student confidence in technology use. Perhaps rather than labeling the iPad as a mobile device or an assistive technology tool, the authors need to look at different terminology to define it. The ownership of this device by post-secondary students is growing every year, and it is a device that does not set students with disabilities apart from their peers. It is a device that can effectively support student learning through built in accessibility features and the use of commonly available and used apps. Perhaps using the term "equalizing technology" to describe the iPad might be more appropriate.*

Originality/value – *This paper discusses the opportunities and limitations afforded by the use of the iPad with post-secondary students as well as suggestions for implementation. This is a rapidly developing area in universities and colleges around the world.*

Keywords *Learning, Apps, m-Learning, Assistive technology, iPad, Post-secondary students*

Paper type *Viewpoint*

1. Introduction

Mobile-learning or m-learning, is the next generation of e-learning. It refers to learning that occurs across locations that takes advantage of the functionality of portable devices such as notebooks, tablets, or smartphones (Maister *et al.*, 2011). These technologies are widely available, are portable and powerful, and are multipurpose offering access to a wide range of functions (McNaughton and Light, 2013).

The authors of this paper have been involved in the field of assistive technology for several decades and have a particular interest in the iPad as a m-learning device for students with special needs. The first author is a special education professor who has been teaching courses to teachers and other educational professional in assistive technology at the undergraduate and graduate levels for many years. Her interest in the iPad for individuals with disabilities stems from

Received 31 October 2014
Revised 19 January 2015
20 February 2015
Accepted 20 February 2015

The authors would like to thank all of the students who participated in their research studies. Phase II of this research would not have been possible without the support of the Athabasca University and a Mission Critical Grant.

a daughter who has a severe neurological disability, as her daughter uses the iPad extensively in her everyday life. The first author has also conducted research focussing on the iPad and the learning of preschoolers with disabilities and the on the use of specific apps to support the learning of middle school students with learning disabilities. The studies have produced very positive results (Chmiliar, 2013). The second author is an advanced iPad user and an Assistive Technology Specialist who works extensively at the post-secondary level, as well as consulting to the disability community. She has worked in the assistive technologies industry in needs assessment, technical support, training, and as a user. Together the authors have been exploring the use of iPads with post-secondary students with disabilities for the last two years. Both authors were attracted by the built in accessibility features in the iPad and the availability of apps to support learning. In a review of the literature, it was discovered that a number of mobile devices have been explored with students in kindergarten to grade 12, but the use of the iPad as an m-learning assistive technology device in post-secondary settings with students with disabilities, is an area still relatively unstudied. Results of the first pilot study (Chmiliar and Anton, 2014) were very promising, and Phase II of the study is in progress. This paper will share research findings of the pilot study with post-secondary students with disabilities, as well as report on the initial findings of Phase II of the project. Practical implementation strategies are provided.

2. Background

The use of mobile devices by kindergarten to grade 12 students with learning challenges has been explored by a number of researchers. Several studies have examined the use of the iPod to support students with disabilities. Burton *et al.* (2013) used video modeling on the iPad to focus on the math skills of four adolescents with autism. The researchers identified a functional relationship between the video self-monitoring on the iPod and math skill acquisition. Video modeling on the iPod was also explored by Cihak *et al.* (2010) to improve transitional behavior for students with autism spectrum disorder. McClanahan *et al.* (2012) worked with fifth-grade students with ADHD to improve literacy in a tutoring situation using activities on the iPod. The results showed that the students made substantial gains in a short period of time. Kagohara *et al.* (2010) worked with an adolescent boy who successfully used an iPod to request snacks using the Proloquo2Go app.

Other studies have focussed in on the use of the iPad to support students with disabilities. Ganz *et al.* (2013) worked with three preschoolers with ASD and found that the children were able to master a communication app on the iPad, and two of the three children preferred using the app to a traditional communication approach. Denski (2010) reported on the use of the iPad loaded with a portable dictionary with students who were learning English. The results indicated that the portable dictionary supported communication. Cumming and Draper Rodriguez (2013) looked at the engagement of four students with language-based disabilities when using the iPad. They found increased engagement and high levels of satisfaction by the teacher and the students with using the iPad. Flores *et al.* (2012) reported that five students with disabilities were able to successfully request a preferred stimuli by selecting icons from an iPad.

The iPad has also been used with students to support learning in academic and behavior areas. Neely *et al.* (2013) focussed on the instructional use of an iPad to deal with challenging behavior and academic engagement of two students. Flores *et al.* (2014) looked that the iPad as a device to deliver literacy-based behavioral interventions and social stories to students. In the area of academics, Kagohara *et al.* (2012) found that an instructional video on how to use the spell-check function of a word processing program with two students with disabilities was effective. Retter *et al.* (2013) looked at the use of the iPad to support the reading skills of secondary students with learning disabilities. Finally, Burton *et al.* (2013) examined the use of video self-modeling on the iPad to teach functional math skills to adolescents and found a functional relationship between the video modeling and math skill acquisition.

The post-secondary learning environment is somewhat different than the K to 12 school experience. Many students at the post-secondary level already own mobile devices that they use in their everyday lives. An Educause report indicated that there has been an increase in mobile technology use by post-secondary students over the past five years from 1.2 percent in 2005, to 62.7 percent in 2010 (Smith and Caruso, 2010). Desantis (2012) reported on a Pearson

Foundation sponsored survey of college students and college bound high school senior high school students, indicating that 25 percent of the students indicated that they owned a tablet, compared to 7 percent in the previous year. Many students indicated a short term plan of purchasing a tablet if they did not own one. The number of students with disabilities enrolling in post-secondary institutions has significantly increased over the past few years (Barnard-Brak *et al.*, 2010). However, no data were found to indicate ownership or use of mobile by post-secondary students with disabilities. That being said, it is likely a safe assumption that the increase in mobile technology use evidenced by post-secondary students in general, would likely be reflected in the data for students with disabilities. This means that many post-secondary students with disabilities may be interested in using, or may already be familiar with mobile devices. It also means that given the popularity of these devices in the general post-secondary population, little stigma would be involved in their use by students with disabilities.

A few studies have emerged in the literature that examine usefulness of the iPad for learning with post-secondary students. In a study by Hahn and Bussell (2012), students in a first-year undergraduate course used iPads loaded with standard apps for one week. Students indicated that they liked: the ready access to wireless on the iPad, the convenience of the iPad due to its portability, the helpful apps they found, and they found apps that increased their productivity. However, the lack of a traditional keyboard was an issue for many students. Miller (2012) reported on a study of students' perceptions of learning and engagement using iPads. Students indicated that the iPad contributed to their learning and engagement. They also reported that learning with the iPad was fun, and they liked the portability of the device. On the other hand, some students expressed difficulties learning how to effectively use the iPad. Mang and Wardley (2012) conducted a six week trial with iPads in three summer courses with 47 students. The iPads were used for note taking, pdf annotation, writing lecture notes, viewing multimedia lecture content, internet exploration, electronic quizzes, writing, and in group activities requiring social interaction. At the conclusion of the study, students reported that they found the iPad to be superior to the laptop for classwork, despite the more limited functionality. Hall and Smith (2011) presented a study on iPad use in a graduate management program. They found that learning outcomes during the study were not significantly improved, although students reported that the iPads provided enhanced convenience and flexibility. Bush and Cameron (2011) in a pilot study, examined the use of the iPad as an e-reader. The majority of students in the study liked the app, iAnnotate, and reported that they liked it as well, or better, than the course materials. The students also reported that the multi-modal functionality of the iPad supported their studying and learning. Both the students and the faculty involved in the study preferred and recommended digital course materials on a tablet to traditional course materials. Geist (2011) conducted a study with senior post-secondary students who used iPads for ten weeks. The students found the iPad useful as an e-reader and that the device offered a great way to access information. The students also reported that the iPad was useful in their clinical work.

Fewer studies were found that examined the use of the iPad with post-secondary students with disabilities. Nee (2012), in a study of eight undergraduate students with self-identified learning disabilities, looked at the use of e-textbooks on the iPad. The study evidenced several positive outcomes. The students indicated that the e-textbooks helped them to improve their academic work, and that the improvement in academic work resulted in increased confidence and self-esteem. Henderson *et al.* (2013) found that students with disabilities in a higher education setting, who used iPads for a period of three weeks, reported that the iPads were engaging and useful. The student indicated that they were actively engaged with the academic environment on the iPad and they liked the size, weight, and portability of the device.

Although a few studies were found that outlined the benefits of iPad use for post-secondary students in general, very little data focussed on post-secondary students with disabilities. Students with disabilities have been enrolling in post-secondary institutions for many years, and institutions work hard to provide these students with support services that will help them to succeed at their course work. The iPad may offer an opportunity to enhance the learning experiences of students in way that was not previously possible (Johnson *et al.*, 2012).

This paper discusses a research project comprised of a pilot project and ongoing Phase II. The project focusses on the use of the iPads as a mobile assistive technology device for students

with disabilities at the post-secondary level. The iPad was chosen as the mobile device for these research projects, as access to a number of iPads to loan to students was readily available. In addition, it was felt that this multipurpose mobile computing device would meet student needs, as it is portable and easy-to-use. The iPad also has a number of built in features to support individuals with disabilities such as "speech select," and a multitude of available learning applications that can support a wide range of learning needs. In addition, the iPads support the provision of a variety of formats including online only, e-textbook via VitalSource, and PDFs of course materials.

3. Method and results

The initial pilot project examined whether the iPad could effectively be used to support two post-secondary students with disabilities in their studies in a distance education course. Several additional questions were considered:

1. How did each student use the iPad?
2. Which apps did the students choose to use and why?
3. Which apps did the students choose not to use and why?
4. Did the iPad, the course materials on the iPad, and the apps helped to support the student in their course work?
5. What supports did the students require to use the iPad effectively in their studies?

The pilot project followed a Participatory Action Research (PAR) model. This model is a method that focusses on co-developing a research program with people rather than for people (McIntrye, 2007). The study involved the student participants in the research process from the beginning of the project to the final conclusions. It is a systematic inquiry, with the collaboration of those affected by the issue being studied for the purpose of education and taking action or effecting change (Green *et al.*, 2003). As such, the participants in this PAR were two students with disabilities who received support in their post-secondary distance courses.

Each student participant had an iPad to use for one course. The course materials for the students were loaded on the iPad manually and the students were offered a range of apps (44), including apps for planning and organization, studying, writing, advance organizers, and communication. The team, including the student, met at the beginning of the study and the students received information about the iPad and the apps that were available to them. A plan was developed together as to how the student was going to use the iPad.

The team met at least once a month throughout the duration of the course. They reviewed how the student was using the iPad and the apps. Any problems or issues were addressed and the team continued to work together to map out a plan to maximize the success of the student. The data collection for this qualitative study was primarily field and interview notes from each meeting with each student. A pre and post interview were also conducted with each student.

The data for each student experience in the pilot study is organized topically by student. The first student in the pilot study was female with a psychiatric disability and difficulties reading and writing. This student owned a number of technologies including a Mac computer, an iPhone, and an iPad Retina, but primarily used her desktop computer to study. She indicated that her preference was to download only free apps on her iPad and she was having difficulties finding anything for free that was helpful. She also expressed her frustration at how difficult it was to find good apps to use in the endless lists of apps available online. By the end of this study, this student had found a number of apps on the iPad that she is using successfully in her studies. The student indicated that she now uses the app, iAnnotate, for everything, describing it as "wicked." The student also used the app, Voice Dream, for reading as it was easy to download materials for reading, and she found the voice in the text to speech function to be more pleasing than in other apps. The student described using the app, Inspiration, for mapping out course content that had to be memorized, and was very pleased with the dictionary app that was provided. The student reported that "[…] if you find something that works for you, you sort of stay with it and don't explore more." She felt that time is very precious as a student, and the time to explore tools to

support learning is very limited. This student indicated that she discovered a lot about how she learns through her exploration and use of apps on the iPad and she is committed to continuing on with the iPad in her studies past the end of the study.

The second student in the pilot project was female with an attention related disability. She has difficulties in writing, idea expression, distractibility, and organization. This student had a DELL laptop and Apple computer that she used for her course work. She uses a smart phone, but had no previous experience with an iPad. During the study the student indicated that she was overwhelmed by the number of apps available to her and she felt that she did not "have time to fool around with them." She indicated that if she had to spend time to figure out an app, she did not want to use it. Over time, she found apps that she liked to use including Pages, Dropbox, Bookshelf, and Dragon Dictation. The student reported that she took the iPad everywhere she went and found that the size and weight of the iPad did not hurt her shoulder injury like her laptop does. The student said that she, "[…] (does her) homework in my truck or at work." She also reported that she used the iPad for almost all of her learning. Her laptop was only being used to format and submit assignments and that she had "[…] not touched (her) computer much in the last month." The student also indicated that the iPad really helped her to "keep […] distractions minimal," as her Facebook and social media distractions were not loaded onto the iPad.

Despite having very different backgrounds and learning needs, the two students in the pilot study reported similar findings in a number of areas. Both students expressed frustration with trying to find apps to support learning, indicating that there are too many choices, not enough time to explore, and too little time as a student to explore and find effective learning tools. Both students indicated a strong preference for apps on the iPad that were easy to figure out and use, that had the features they required for learning. Once the students found apps that met their needs, they were happy to incorporate the apps into their learning routines, and both students reported that when they found an app that worked for them – they were "kind of stuck on what (they) liked." They reported that many of the apps were frustrating to learn how to use, and if they could not figure them out quickly, they just dropped use of the app. Both students experienced app specific difficulties including: difficulties figuring out how to import data into flashcard apps, and difficulties with the functionality of highlighting in one of the reading apps. Both students were surprised at what they were able to do on the iPad and both students found apps loaded on the iPad that met the majority of their specific learning needs. The students reported that they were pleased with their success on the iPad. Surprisingly, the students indicated a preference for working on their course on the iPad, and both students evidenced a move to this device from the technologies that they had been previously been using.

The current Phase II of this research project is similar to the pilot project, but builds on the results from the pilot project. The objectives of the current Phase II of the research project were extended to examine whether the iPad can effectively be used to support eight post-secondary students with a range of different disabilities, in their studies in a distance education course. The research questions remain very similar:

RQ1. How did each student use the iPad?
RQ2. Which apps did the students choose to use and why?
RQ3. Which apps did the students choose not to use and why?
RQ4. Did the iPad, the course materials on the iPad, and the apps helped to support the student in their course work?
RQ5. What supports did the students require to use the iPad effectively in their studies?

An additional questions was added for Phase II:

RQ6. What are the students' perspectives on the supports that they were provided?

The current Phase II is also following a PAR model where the student participants are involved in the research process from the beginning of the project. However, in the current Phase II of this research, a number of changes to the Pilot Project were implemented. In the current research project, eight students with disabilities were provided with iPads on which to complete their course work. Prior to receiving the iPads, a technology assessment was conducted with the students to determine each student's learning and technology support needs. Each iPad was customized to the student's needs with regard to their individualized learning environment. This is

a change from the previous pilot study where 44 apps were installed on all the iPads identically. Fewer apps were loaded onto the iPads and the apps that were loaded were specifically targeted to student needs. In addition, support materials on how to use specific apps, in the form of videos and PDF directions were provided to the participants and continue to be provided on an as needed basis. These materials are being provided as the result of the participants in the pilot study indicating that if an app was too hard to learn, they abandoned use of the app.

In the current research project, mobile device management was used to configure the iPads to speed up the downloading and management of apps. This is a layered ownership model where the institution retains ownership of purchased apps and students have the option to acquire the apps they desire during their course of the study. With the iPads, this customization was relatively easy to achieve and the Volume Purchase Program ensured that the customization was reasonably priced.

Part way into Phase II of the research, it appears that the customization approach has increased student engagement with the iPads. The initial interviews indicated that all of the students are pleased with the learning that they are experiencing on the iPad and two students have already indicated that they will be considering the iPad for future courses. One student reported that she started the study as a skeptic because she does not believe in technology use, but has found that the iPad has made her studies and life simpler. All of the students have indicated that the portability of the tool is an important factor and one student has reported a reduction in headaches when reading course materials on the iPad. All the students have reported that they quickly found apps that met their learning needs on the iPad. With customized apps for each student on the iPad, the negative comments by the students in the pilot study regarding frustration with going through large number of apps to find what was useful for them was reduced. The apps that each student indicated that they like the best and used the most has differed substantially from student to student in the initial interviews. At this point, the students are continuing to request additional apps as their exploration of the iPad continues. There are continued concerns about the inability to update apps. Student feedback regarding the support materials that are being provided also continues. The initial results are very interesting, and full descriptions of the iPad use will be developed at the conclusion of the Phase II.

4. Limitations

A limitation of the pilot study was that the research focussed on only two post-secondary students with disabilities. In Phase II of the research, the participant pool has now been expanded to eight students with a greater range of learning challenges and needs. Although this is still a small number of students, it does represent a larger participant pool.

In Phase II of the research project, several limitations of the iPad in terms of deployment and administrative management were noted. First, the conversion of course materials for use in the various apps continues to be a very time consuming endeavor. No solutions to this limitation have been found at this point in time, although one solution might be to provide students with the tools to convert materials to whatever format they preferred. Second, with single app id installation, configuration using iTunes for app installation does not allow for updates as the students are using the iPad. Several students have indicated that this is a concern for them. Third, when using university iPads for research, the students' perception of ownership and care of the devices may have hindered their personal customization to meet their learning needs, despite assurances that they could do what they wanted to for customization.

5. Implications for practice

A number of suggestions for the implementation of iPads at the post-secondary level have emerged from the data:

- Post-secondary students need support in learning how to use the iPad for learning. Students are frequently familiar with the device for using social media, e-mail, watching videos, etc., but they are unfamiliar with incorporating the device into their studies. The participants in the pilot study indicated that time is a huge issue for them. If students have to take too much time to

learn how to use the device, find apps that are suitable for them, or struggle to learn an app, they will not engage with the device. Training prior to the beginning of a course(s) for students is essential for engagement and access to support throughout the course is also helpful. Support materials on how to learn to use useful apps quickly can be effective in helping students to engage with the iPad. In the pilot study, students gravitated to, and used the apps that were demonstrated for them. In the initial results of Phase II of the study, it was noted that students responded very well to support and materials that demonstrated app use and tended to explore and use those apps.

- Students need to know good effective apps that will help them accomplish their learning goals and support their needs. There are too many app choices available, and students indicate that they do not have time to explore what is available to find what they might want. Students also indicated that they often download something they think might be helpful, only to find out that the app does not meet their needs. They need ready access to names of apps and their features. The apps need to be simple and easy to use, but meet the functional needs of post-secondary student. Initial support in how to use specific apps may be necessary for students.
- Students need support to understand how to use apps effectively in their learning and how specific apps can help them overcome their learning challenges. It is necessary to explore with students how they learn best and help them find and use apps that will support how they learn. For example, one student indicated that she was a visual learner and she was having difficulties remembering history material for exams. This student was shown how to use a visual mapping app to study and later reported that the app had a significant positive impact on her studying and that she was incorporating the use of this app into other courses as well.
- The choice of apps to use is very different for each student and their choices reflect their learning needs and the course they were enrolled in. An app that one student loves, is not necessarily an app that another student will like. Although apps like Drop Box were consistently used by students, it is important that several proven apps should be offered to the student. Students can then choose the app that best matches their needs.
- When using university iPads for research, the students' perception of ownership and care of the devices may hindered their personal customization to meet their learning needs. If it is desirable to have to students to customize their learning experience on the iPad to support their learning, perhaps student ownership of devices needs to come into the conversation.

6. Conclusion

In conclusion, the research discussion in the literature review reported positive findings on the use of the iPad with students in kindergarten to grade 12, and with post-secondary students. Limited research on the use of iPads with post-secondary students with disabilities was found, but data indicates that students reported positive experiences with this device. The data gathered in this research project in the pilot study and in the ongoing Phase II of the research is very positive, with students indicating that they are finding and using apps that effectively support their learning. Students have also reported that they are moving away from the assistive technologies that they were previously using, to use of apps on the iPad. Several students indicated that use of the iPad has changed their learning, and one even went so far to say that using the iPad for course work has made her life simpler and easier. Given this growing body of data, it is becoming evident that the iPad as a m-learning assistive device may offer significant opportunities for learning for post-secondary students with disabilities. Perhaps rather than labeling the iPad as a mobile device or an assistive technology tool, we need to look at different terminology to define it. The ownership of this device by post-secondary students is growing every year, and it is a mainstream device that does not set students with disabilities apart from their peers. It is a device that can effectively support student learning through built in accessibility features and the use of commonly available and used apps. Perhaps using the term "equalizing technology" to describe the iPad might be more appropriate.

References

Barnard-Brak, L., Lechtenbeger, D. and Lan, W. (2010), "Accommodation strategies of college students with disabilities", *The Qualitative Report*, Vol. 15 No. 2, pp. 411-29.

Burton, C., Anderson, D., Prater, M. and Dyches, T. (2013), "Video self-modeling on an iPad to teach functional math skills to adolescents with autism and intellectual disability", *Focus on Autism and Other Developmental Disabilities*, Vol. 28 No. 2, pp. 67-77.

Bush, M. and Cameron, A. (2011), "Digital course materials a case study of the Apple iPad in the academic environment", dissertation, Institute Pepperdine University, available at: http://pepperdine.contentdm.oclc.org/cdm/ref/collection/p15093coll2/id/139 (accessed October 30, 2014).

Chmiliar, L. (2013), "The iPad and the preschool child with learning difficulties", *Journal on Technology and Persons with Disabilities*, Vol. 1, pp. 191-200.

Chmiliar, L. and Anton, C. (2014), "The iPad as a mobile learning tool for post-secondary students with disabilities", in Miesenberger, K., *et al.* (Eds), *ICCHP 2014 Part II LNC 5848*, Springer International Publishing, pp. 597-600.

Cihak, D., Fahrenkrog, C., Ayres, K. and Smith, C. (2010), "The use of video modelling via a video iPod and a system of least prompts to improve transitional behaviors for students with autism spectrum disorders in the general education classroom", *Journal of Positive Behavioral Interventions*, Vol. 12 No. 2, pp. 103-15.

Cumming, T. and Draper Rodriguez, C. (2013), "Integrating the iPad into language arts instruction for students with disabilities: engagement and perspectives", *Journal of Special Education Technology*, Vol. 28 No. 4, pp. 43-53.

Denski, J. (2010), "The device versus the book", *Campus Technology*, Vol. 24 No. 9, pp. 26-34.

Desantis, N. (2012), "Tablet ownership triples among college students", *Chronicle of Higher Education*, Vol. 58 No. 29, available at: http://chronicle.com/blogs/wiredcampus/tablet-ownership-triples-among-college-students/35764 (accessed October 30, 2014).

Flores, M., Hill, D., Faciane, L., Edwards, M., Tapley, S. and Dowling, S. (2014), "The Apple iPad as assistive technology for story-based interventions", *Journal of Special Education Technology*, Vol. 29 No. 2, pp. 27-38, available at: http://connection.ebscohost.com/c/articles/95605715/apple-ipad-as-assistive-technology-story-based-interventions (accessed February 19, 2015).

Flores, M., Musgrove, K., Renner, S., Hinton, V., Strozier, S., Franklin, S. and Hill, D. (2012), "A comparison of communication using the Apple iPad and a picture-based communication system", *Augmentative and Alternative Communication*, Vol. 28 No. 2, pp. 27-38.

Ganz, J., Hong, E. and Goodwyn, F. (2013), "Effectiveness of the PECS Phase III app and choice between the app and traditional PECS among preschoolers with ASD", *Research in Autism Spectrum Disorders*, Vol. 7 No. 8, pp. 973-83.

Geist, E. (2011), "The game changer: using iPads in college teacher education classes", *College Student Journal*, Vol. 45 No. 4, pp. 757-68.

Green, L., George, A., Daniel, M., Frankish, J., Herbert, C., Bowled, W. and O'Neil, M. (2003), "Appendix C: guidelines for participatory research in health promotion", in Minkler, M. and Nina, W. (Eds), *Community-Based Participatory Research for Health: From Process to Outcomes*, 2nd ed., Jossey-Bass, Inc., San Francisco, CA.

Hahn, J. and Bussell, H. (2012), "Curricular use of the iPad 2 by a first-year undergraduate learning community", *Library Technology Reports*, Vol. 48 No. 8, pp. 42-7.

Hall, O. and Smith, D. (2011), "Assessing the role of mobile learning systems in graduate management education", in Kwan, R., *et al.* (Ed.), *Hybrid Learning: Lecture Notes in Computer Science 6837*, Springer, Berlin, pp. 279-88.

Henderson, K., Gibson, C. and Gibb, F. (2013), "The impact of tablet computers on students with disabilities in a higher education setting", *Technology and Disability*, Vol. 25, pp. 61-76.

Johnson, L., Adams, S. and Cummins, M. (2012), *NMC Horizon Report: 2012 Higher Education Edition*, New Media Consortium, Austin, TX.

Kagohara, D., Sigafoos, J., Achmadi, D., O-Reilly, J. and Lancioni, G. (2012), "Teaching children with autism spectrum disorders to check the spelling of words", *Research in Autism Spectrum Disorders*, Vol. 6 No. 1, pp. 304-10.

Kagohara, D., Der Meer, V., Achmadi, L., Green, D., O'reilly, V., Mulloy, M., *et al.* (2010), "Behavioral intervention promotes successful use of an iPod-based communication device by an adolescent with autism", *Clinical Case Studies*, Vol. 9 No. 5, pp. 328-38.

McClanahan, B., Williams, K., Kennedy, E. and Tate, S. (2012), "How use of an iPad facilitates reading improvement", *TechTrends*, Vol. 56 No. 3, pp. 20-8.

McIntrye, A. (2012), *Participatory Action Research*, A SAGE Univeristy Paper, SAGE Publication, Google eBook, Thousand Oaks, CA.

McNaughton, D. and Light, J. (2013), "The iPad and mobile technology revolution: benefits and challenges for individuals who require augmentative and alternative communication", *Augmentative and Alternative Communication*, Vol. 29 No. 2, pp. 107-16.

Maister, J., Kananeer, E. and VonFeldt, R. (2011), "2011: the year of the media table as a learning tool", *Technology and Development*, Vol. 65 No. 4, pp. 28-31.

Mang, C. and Wardley, L. (2012), "Effective adoption of tablets in post-secondary education: recommendations based on a trial of iPads in university classes", *Journal of Information Technology Education: Innovations in Practice*, Vol. 11, pp. 301-17, available at: http://eric.ed.gov/?id=EJ990985 (accessed October 3, 2014).

Miller, W. (2012), "iTeaching and learning, collegiate instruction incorporating mobile tablets", *Library Technology Reports*, Vol. 48 No. 8, pp. 54-9.

Nee, E. (2012), "College students with learning disabilities: experiences using e-texts", dissertation, Johnson and Wales University, Malibu, CA, available at: http://scholarsarchive.jwu.edu/dissertations/AAI3505509/ (accessed October 30, 2014).

Neely, L., Rispoli, M., Camargo, S., Davis, J. and Boles, M. (2013), "The effect of instructional use of an iPad on challenging behavior and academic engagement for two students with autism", *Research in Autism Spectrum Disorders*, Vol. 7 No. 4, pp. 509-16.

Retter, S., Anderson, C. and Kieran, L. (2013), "iPad use for accelerating gains in reading skills of secondary students with learning disabilities", *Journal of Educational Multimedia and Hypermedia*, Vol. 22 No. 4, pp. 443-64.

Smith, S. and Caruso, B. (2010), *The ECAR Study of Undergraduate Students and Information Technology*, Educause Center for Applied Research, Boulder, CO.

Further reading

Edmonds, C.D. (2004), "Providing access to students with disabilities in online distance education: legal and technical concerns for higher education", *The American Journal of Distance Education*, Vol. 18 No. 1, pp. 51-62.

About the authors

Dr Linda Chmiliar is an Associate Professor at the Athabasca University and coordinates a Diploma in Inclusive Education an after degree for teachers. Linda has conducted several research projects on the use of the iPad for learning in the last couple of years. Dr Linda Chmiliar is the corresponding author and can be contacted at: lindac@athabascau.ca

Carrie Anton is an Assistive Technologist with the Athabasca University.

This article has been cited by:

1. Jalal Ismaili, El Houcine Ouazzani Ibrahimi. 2016. Mobile learning as alternative to assistive technology devices for special needs students. *Education and Information Technologies* . [CrossRef]