The Use of Mobile Devices for Students with Disabilities In Higher Education: Al-Zaytoonah University Of Jordan As A Case Study

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ABSTRACT

This study looks into how technology can be used to help students with disabilities in higher education. It will look at how mobile devices can help students who are isolated due to illness or disability, as well as how mobile devices can help students with a variety of communication difficulties. Individuals with disabilities are more likely to have a lower educational level (Kattari et al. 2020). Part of the reason for their poor performance is that they do not always receive the same inclusive education as persons who do not have disabilities. People with impairments can receive assistance in a variety of ways. One way, which was the subject of this study, is to give them access to mobile devices in order to improve their communication and learning experiences. Definitions of disability are difficult to come by, and there is certainly no consensus. The underlying objective of discussion, debate, research, or data collection influences the definitions. There is also a problem with labeling someone with a disability and, as a result, reducing the person's visibility. A greater focus on diversity, rather than handicap, has been a significant step forward. However, in a world where funding is scarce but necessary, disability definitions are critical for ensuring equitable access to support services and facilities, as well as ensuring that appropriate measures are taken to ensure accessibility for individuals in all aspects of daily life, including access to appropriate education.

This research begins with an overview of mobile device use in education in terms of Universal Design for Learning principles and the accessibility features of mobile devices to enhance student communication. The communication applications for mobile devices role in education were then detailed in depth. The study concludes with suggestions for how mobile devices can be used to

help students with disabilities in the future.

Keywords: Mobile Devices, Universal Design, Learning

1. INTRODUCTION OF MOBILE DEVICES IN EDUCATION

Reasonable adaptations in the form of assistive technologies can be made to accommodate disabled higher education students in a range of educational contexts. Any device that aids a student's communication, cognitive, physical, and/or learning needs is referred to as assistive technology (du Plessis, 2013). The Assistive Technology Act of 2004 in the United States defines assistive technology as “any item, piece of equipment or product system, whether acquired commercially or off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities” (Kapsiak, 2018)

Assistive technologies are thought to have the biggest impact on independent living for people with impairments, allowing them to participate in activities that were previously impossible (Sanford and Remillard, 2021). Unfortunately, not everyone has equal access to these gadgets, with “80 percent of people with disabilities in poor countries having limited access to assistive and accessible technology.” Most people in the industrialized world do not have access to many of the developing or widely used ICTs, such as smartphones and tablets” (G3ict, 2015).

According to new findings, mobile devices offer the ability to provide a more equal education to students with impairments. The best evidence for effective inclusive education for students with disabilities was published in a review of multiple studies on students with disabilities from various educational levels, particularly higher education. Identify the use of assistive and adaptive technologies to enable access to physical environments, mobility, effective communication, and functional skill enhancement, such as using mobile learning technologies in the learning process has been cited as improving student productivity, creativity, and engagement while allowing for differentiated, explicit and individualized instruction (Saran et al. 2020)” (Kramarenko et al. 2021) and (Svensson et al. 2021).

The term "mobile device" refers to a variety of various gadgets. The iPod was one of the first technologies to make its way into formal education, followed by the iPad and tablet devices. The standard laptop's portability, as well as variants with 2 in 1 characteristics (a removable keyboard that transforms the laptop into a tablet), expanded laptop incorporation into formal education. While laptops are not as portable as iPods or tablets, they do enable for the use of a wider range of software programs than some tablet devices allow. E-readers, smartphones, and handheld

gaming devices are other mobile gadgets that can help students with special needs. These devices now have Internet access, allowing them to be used in a variety of ways (Rosell, 2021).

Various studies have shown that each type of mobile device has significance in supporting the education of students with disabilities. For example, the iPod device has been utilized to help students with special needs improve their communication abilities (Cheng and Lai, 2020). iPads and other tablet devices are being utilized to assist students with visual impairments and literacy challenges (Beal and Rosenblum, 2018). The iPad has also been studied as a leisure tool that allows students to access video and audio (Hammond et al. 2010). Smartphones are finding their way into educational and rehabilitative programs for disabled people (Johansson et al. 2021). While laptops have been found to assist a variety of educational outcomes, including the teaching of daily living skills such as purchasing and preparing food, they have not been proven to support the teaching of daily living skills (Srijamdee and Pholphirul, 2020).

The usage of mobile devices in formal education is becoming increasingly acceptable and desirable as Bring Your Own Device (BYOD) rules have become popular across both public and private institutions (De Kock, 2017). Assistive gadgets have traditionally been used by students with communication difficulties to help them communicate more effectively. Such specialized equipment were frequently prohibitively expensive, and they were also inconvenient. The widespread use of mobile devices by students and adolescents has increased the potential for these devices to support individual students' communication under the inclusive education principles of normalization and age-appropriateness, allowing students with communication challenges to use popular, peer-accepted devices to communicate with peers and teachers.

While mobile devices have the potential to facilitate contact between people with disabilities and/or those who are isolated, this can only happen if the devices are accessible. We'll now look at the accessibility characteristics of mobile devices using the Universal Design for learning lens.

2. MOBILE DEVICES AND COMMUNICATION UNIVERSAL DESIGN FOR LEARNING

The concept of Universal Design is credited to architect Ron Mace, who aspired to produce goods and settings that are usable by everybody, and that such accessible design from the start would save time and money in the long term, while also benefiting persons with disabilities (Huff, 2020). Buildings with ramp access and automatic doors; braille keypads; closed captions built into televisions; pedestrian alerts with lights and sound are all examples of Universal Design in action.

As shown in Table 1, there are seven key concepts of Universal Design.

Table 1: Principles of Universal Design

Seven principles of universal design		
1	Equitable use	The design is useful and marketable to people with diverse abilities: • It avoids segregating or stigmatizing any users by providing the same means of usage for all users: identical whenever possible; equal when not. • All users have equal access to privacy, security, and safety features. • The design appeals to a wide range of people.
2	Flexibility in use	The design accommodates a wide range of individual preferences and abilities: • It gives users a variety of options for how to use it. • It can be used and accessed by either the right or left hand. • It aids the user's precision and accuracy. • It is able to adjust to the user's pace.
3	Simple and intuitive use	Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration levels: • It eliminates unnecessary complexity. • It is consistent with user expectations and intuition. • It accommodates a wide range of literacy and language skills. • It arranges information consistent with its importance. • It provides effective prompting and feedback during and after task completion.
4	Perceptible information	The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities: • It uses different modes (pictorial, verbal, tactile) for redundant presentation of essential information. • It provides adequate contrast between essential information and its surroundings. • It maximizes "legibility" of essential information. • It differentiates elements in ways that can be described (i.e., make it easy to give instructions or directions). • It provides compatibility with a variety of techniques or devices used by people with sensory limitations.
5	Tolerance for error	The design minimizes hazards and the adverse consequences of accidental or unintended actions: • It arranges elements to minimize hazards and errors: most used elements, most accessible; hazardous elements eliminated, isolated, or shielded. • It provides warnings of hazards and errors. • It provides fail safe features. • It discourages unconscious action in tasks that require vigilance.
6	Low physical effort	The design can be used efficiently and comfortably with a minimum of fatigue: • It allows user to maintain a neutral body position • It uses reasonable operating forces. • It minimizes repetitive actions. • It minimizes sustained physical effort.
7	Size and space for approach use	Appropriate size and space is provided for approach, reach manipulation and use regardless of a user's body size, posture or mobility: • It provides a clear line of sight to important elements for any seated or standing user. • It makes reaching to all components comfortable for any seated or standing user. • It accommodates variations in hand and grip size. • It provides adequate space for the use of assistive devices or personal assistance.

The usefulness of Universal Design in promoting accessibility for varied populations has led to the development of Universal Design for learning principles in the realm of education (UDL) (Rogers-Shaw ET AL. 2018). UDL is defined by three characteristics: representation, engagement, and expressiveness. Table 2, Table 3, and Table 4 demonstrate the characteristics of each of these three components, based on a combination of (Rogers-Shaw ET AL. 2018) and

(Gargiulo and Metcalf definitions, 2013).

TABLE 2: UDL – multiple means of representation

Multiple means of REPRESENTATION (the 'what' of teaching and learning)		
Offers flexible/multiple ways t present lesson content	Auditory	Lecturing, presenting orally through a character, singing, reading aloud
	Visual	Reading articles/books, watching video clips or slideshows, displaying a poster, chart, graph, or slide, attending a play, employing sign language, and providing an advanced organizer are all options.
	tactile/kinesthetic	Taking a field trip, demonstrating (e.g., sketching, sculpting, creating, playing a game), utilizing sign language/gestures, and using Braille are all options.
	affective	Presenting to big or small groups, one-on-one presentations or tutorials, cross-age tutoring, role playing, and connecting to student interests are all possible options.
	technological	Document displayer, electronic whiteboard, audio books, video/DVD, television/VCR (closed captioning), podcasts, online lessons, and websites

TABLE 3: UDL – multiple means of engagement

Multiple means of ENGAGEMENT (the 'why'' of teaching and learning)		
Offers flexible/multiple wa to present lesson content	auditory	Listening to literature read aloud, debating, discussing, providing verbal cues, walking through steps, employing songs/raps, and oral storytelling are all examples of oral storytelling.
	visual	Using a visual schedule, designing posters, illustrating/taking pictures, posting goals, charting progress, outlining steps to solving a problem, using a visual schedule, posting goals, charting progress, outlining steps to solving a problem, using a visual schedule, using a visual schedule, using a visual schedule, using a visual schedule
	tactile/kinesthetic	Using manipulative, building a model, using response cards, using a game format, working outside, building movement into lessons, role plays
	affective	Working in areas of student interest with some choice, alone, with a peer, or in cooperative groups, employing positive behavior support, strengthening self-regulation, developing coping skills, providing feedback, and bringing in mentors
	technological	Using a digital device to record, word processing, spreadsheets to chart data, making a video, wikis or video conferencing, blogging, and text messaging are all options.

TABLE 4: UDL – multiple means of expression

Multiple means of EXPRESSION (the 'what' of teaching and learning)		
Offers flexible/multiple wa present lesson content	auditory	Oral report, speech/debate, song/rap, storytelling, interview

	visual	Written report, drawing/poster, portfolio, journal/diary, mural, and visual demonstration utilizing chart or graph
	tactile/kinesthetic	Demonstration of an experiment, dance, written report, pointing or gazing at answers, filling in a sheet, puppet show
	affective	Group presentation or response, drama/play production, role play demonstration
	technological	A voice recording, multimedia productions, podcast, electronic book production, photographic essay, word-processed report, electronic assessment, webquest creation

Built-in accessibility features for mobile devices have allowed users with disabilities to access and participate in a variety of educational and social experiences that they might not have had otherwise, and have provided options to make services more accessible to: deaf and hard of hearing users; blind and low vision users; users with low dexterity or limited mobility (Hashey and Stahl, 2014). Table 5 (Apple devices) and Table 6 (Microsoft devices) lists the various features provided in mobile devices that aid accessibility for those with a variety of connectivity issues.

TABLE 5: Features to support accessibility: Apple products, adapted from Apple (undated)

Features to support accessibility: Apple products	
Vision	VoiceOver, Zoom, Dictation, Contrast Options, Cursor Size, plug-in Braille displays
Hearing	Facetime, Closed Captions, iMessage, Screen Flash (visual beep instead of alert sound), Mono audio
Physical and mo skills	Switch controls, Slow Keys, Sticky Keys, Dictation Commands, Mouse Keys, Onscreen Keyboard
Learning and literacy	Simple Finder, Dictionary, Text to Speech, Word Completion
Speech	Facetime, iMessage, Text to Speech

TABLE 6: Features to support accessibility: Microsoft products, adapted from Hubbell & Petty, 2015)

Features to support accessibility: Microsoft products	
Vision	adjust sizes (font, icons, cursor, tiles, text apps), use magnifier, create custom colours, narrator, keyboard shortcuts, third-party screen readers, braille display devices
Hearing	adjust volume, sounds, use text or visual alternatives for sound, closed captioning, Skype and skype translator
Mobility	easier-to-use keyboard (sticky Keys, Filter Keys, keyboard shortcuts), options to use computer without mouse or keyboard (speech recognition, touch devices, head/eye tracking devices), alternative input devices (ergonomic keyboards and mice, joysticks, trackballs, switches, touch screens, etc)
Learning and literacy	improve focus: turn off animations and background images and live tiles consuming content: change colour, text size, reading mode expressing yourself: speech recognition, word prediction, alternate input devices such as large-key keyboards

Access is further enhanced by the integration of extra assistive devices that link to laptop (and some tablet device) technology, in addition to the capabilities integrated into various mobile devices. Keyboard adaptations (onscreen keyboards, Intelli keys), mouse control alternatives (trackballs, joysticks, touch pads, head pointers, mouse keys, eye gaze and tracking), switches,

and voice input and text-to-speech software are examples of such assistance technologies (Croser, 2015).

3. COMMUNICATION APPLICATIONS FOR MOBILE DEVICES

With over 1.5 million apps available in the iTunes store and over two million apps available on Google Play (Statista, 2016), there is a significant number of apps to support communication in a variety of ways, regardless of whether the communication challenge arises as a result of a cognitive or physical disability, social communication disorder, or exclusion or isolation.

The following are the most common types of apps and extensions available to help students with a cognitive or physical disability and/or a social communication disorder communicate:

- Enhanced and alternative communication boards (constructing sentences from symbols and pictures)
- Customized boards created from photographs shot by the device's camera
- Text-to-speech
- Speech - to-text
- Audio and read-aloud books
- Personal listening treatment
- Timetabling, sequencing, and scheduling
- Nonverbal and emotional cues
- Storyboards
- Apps for articulation

In the case of students who are excluded or isolated from regular schooling due to a disability or illness, mobile devices provide a variety of communication tools that allow the student to communicate with his or her teacher and peers while also continuing to participate in the learning experiences taking place in his or her regular classroom. Here are a few examples:

- social networking sites
- social media sites
- video conferencing systems
- discussion boards
- email

There are also a plethora of apps and websites that allow parents and instructors to obtain pertinent

data about student behavior and performance. This type of data gathering on young people with communication difficulties is necessary so that appropriate interventions can be implemented to help them achieve good learning outcomes. The use of mobile devices to assess young people with impairments has grown more frequent in recent years. With young people with disabilities, conventional written or verbal assessments can be difficult, and the use of mobile devices allows teachers, support workers, and parents to gather data that can be used to monitor progress and direct interventions to help them. “Moving examinations to mobile devices could provide students and teachers with faster feedback as well as more data” (Ash, 2012). The assessment information may be obtained swiftly, unobtrusively, and informally using iPads, which reduces student stress. It can then be rapidly sent to all of the student's supporters, including the parents. This creates an atmosphere in which all stakeholders have access to materials, allowing the young person to benefit from a more integrated learning experience.

Teachers can simply record lectures on the iPad, allowing them to collect valuable information. For example, the iPad may be used to easily record fractions interviews with students (Morrison et al. 2015). Using the iPad, teachers may easily enter information about their students into data bases. What's important about online records is that they can be transferred in real time to centralized databases. This is especially significant for disabled people who may spend time in a variety of educational and medical settings.

4. FUTURE DIRECTIONS

Mobile technology advances at a breakneck speed, and it's only becoming faster. This makes it difficult to predict the future with any certainty. However, there are some advancements that appear to be promising in terms of assisting persons with disabilities. “We can expect two-thirds of the world population to have massive computer power at their fingertips in the near future,” says one projection (McKinsey & Company & GSMA, 2012). A large number of young people with impairments will benefit from greater educational possibilities as a result of this.

Adaptive technology will become more ubiquitous in classrooms during the next years. Adaptive technology helps students learn by assisting teachers in monitoring important learner characteristics and making appropriate adjustments to the instructional milieu to support and enhance learning.... for students with a variety of abilities, disabilities, interests, backgrounds, and other characteristics (Hasselbring and Glaser, 2000).

Personalised learning can now be a component of the learning environment thanks to adaptive technology (Walkington, 2013). Personalized learning" refers to a wide range of educational programs, learning designs, instructional approaches, and academic support measures aimed at meeting individual students' unique learning needs, interests, goals, and cultural backgrounds. Adaptive technologies can also help students with special needs achieve better learning results. Learning analytics is one type of adaptive technology that allows teachers to better analyze their students. The measurement, gathering, analysis, and reporting of data about learners and their contexts for the sake of understanding and optimizing learning and the environments in which it occurs is how learning analytics is defined (Roberts-Mahoney et al. (2016).

5. CONCLUSION

This chapter provided an overview of disability challenges in inclusive education, with a focus on communication issues. The chapter then proceeded on to discuss the usage of mobile devices in education in terms of Universal Design for Learning principles and mobile device accessibility features for student communication.

The challenge of linking students so that they can both learn and socialize with their friends was highlighted in the illustrated case study. In order to achieve positive outcomes, it is critical to have a holistic approach to assisting young people with disabilities in which all stakeholders are involved.

Mobile technologies are fast evolving, presenting new opportunities for students to engage on a more equal footing with their classmates in schools through inclusion education. With these evolving technologies, more systematic study is needed to assess the usefulness of mobile devices in improving individual students' communication experiences across a wide range of educational situations and determining the long-term impact on their overall learning chances.

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REFERENCES

Ash, K. (2012). Rethinking testing in the age of the iPad: Schools administer assessments via mobile device. Digital Directions, 5(2), 36-40.

Beal, C. R., & Rosenblum, L. P. (2018). Evaluation of the effectiveness of a tablet computer application (App) in helping students with visual impairments solve mathematics problems. Journal of visual impairment & blindness, 112(1), 5-19.

Cheng, S. C., & Lai, C. L. (2020). Facilitating learning for students with special needs: a review of technology-supported special education studies. Journal of computers in education, 7(2), 131-153.

Croser, R. (2015). Inclusive Technology. In A. Ashman (Ed.), Education for Inclusion and Diversity (5th ed.). Melbourne, Vic: Pearson Australia.

De Kock, R. (2017). A framework for implementing bring your own device in higher education institutions in South Africa (Doctoral dissertation, Nelson Mandela Metropolitan University).

Du Plessis, A. (2021). Using Information Communication Technologies and Assistive Technologies to Address Specific Barriers to Teaching and Learning in Schools. In Empowering Students and Maximising Inclusiveness and Equality through ICT (pp. 88-113). Brill Sense.

G3ict. (2015). CRPD Implementation: Promoting global digital inclusion through ICT procurement policies and accessibility standards.

Gargiulo, R. M., & Metcalf, D. (2013). Teaching in Today's Inclusive Classrooms: A universal design for learning approach (2nd ed.). Belmont, CA: Wadsworth Cengage Learning.

Hammond, D. L., Whatley, A. D., Ayres, K. M., & Gast, D. L. (2010). Effectiveness of video modeling to teach iPod use to students with moderate intellectual disabilities. *Education and Training in Autism and Developmental Disabilities, 45*, 525–538

Hashey, A. I., & Stahl, S. (2014). Making online learning accessible for students with disabilities. Teaching exceptional children, 46(5), 70-78.

Hasselbring, T. S., & Glaser, C. H. W. (2000). Use of computer technology to help students with special needs. The future of children, 102-122.

Huff, D. (2020). Expanding universal design applications within residential homes to maximize person-environment fit for children with intellectual disabilities as they age in place.

Johansson, S., Gulliksen, J., & Gustavsson, C. (2021). Disability digital divide: the use of the internet, smartphones, computers and tablets among people with disabilities in Sweden. Universal Access in the Information Society, 20(1), 105-120.

Kapsiak, J. A. (2018). Impact of Assistive Technology Devices for Students Identified with a Disability and an Academic Need in Reading (Doctoral dissertation, faculty of the Graduate School of the University at Buffalo, The State University of New York).

Kattari, S. K., Bakko, M., Hecht, H. K., & Kattari, L. (2020). Correlations between healthcare provider interactions and mental health among transgender and nonbinary adults. SSM-population health, 10, 100525.

Kramarenko, T., Bondar, K., & Shestopalova, O. (2021, March). The ICT usage in teaching mathematics to students with special educational needs. In Journal of Physics: Conference Series (Vol. 1840, No. 1, p. 012009). IOP Publishing.

McKinsey & Company, a GSMA (2012). Transforming learning through mEducation. Retrieved from http://www.gsma.com/connectedliving/wp-content/uploads/2012/04 /gsmamckinseytransforminglearningthroughmeducation.pdf

Morrison, M., Leah, J., Harvey, F., & Masters, C. (2015). Embedding the iPad as a learning and teaching tool: A case study of staff and student perspectives in a management school (pp. 39-59). Cambridge Scholars Publishing: Newcastle, UK.

Roberts-Mahoney, H., Means, A. J., & Garrison, M. J. (2016). Netflixing human capital development: Personalized learning technology and the corporatization of K-12 education. Journal of Education Policy, 31(4), 405-420.

Rogers-Shaw, C., Carr-Chellman, D. J., & Choi, J. (2018). Universal design for learning: Guidelines for accessible online instruction. Adult learning, 29(1), 20-31.

Rosell Aguilar, F. (2021). Evaluating the use of mobile technologies for language learning purposes (Doctoral dissertation, Universitat Politècnica de València).

Sanford, J. A., & Remillard, E. T. (2021). Design for One is Design for All: The Past, Present, and Future of Universal Design as a Strategy for Ageing-in-Place with Disability. In Handbook on Ageing with Disability (pp. 169-185). Routledge.

Saran, A., White, H., & Kuper, H. (2020). Evidence and gap map of studies assessing the effectiveness of interventions for people with disabilities in low-and middle-income countries. Campbell Systematic Reviews, 16(1), e1070.

Srijamdee, K., & Pholphirul, P. (2020). Does ICT familiarity always help promote educational outcomes? Empirical evidence from PISA-Thailand. Education and Information Technologies, 25(4), 2933-2970.
Statista (2016). Number of apps available in leading app stores as of July 2015. Retrieved: http://www.statista.com/statistics/276623/number-of-apps-available-in- leading-app-stores/ 25 May 2016.ffff

Svensson, I., Nordström, T., Lindeblad, E., Gustafson, S., Björn, M., Sand, C., ... & Nilsson, S. (2021). Effects of assistive technology for students with reading and writing disabilities. Disability and Rehabilitation: Assistive Technology, 16(2), 196-208.

Walkington, C. A. (2013). Using adaptive learning technologies to personalize instruction to student interests: The impact of relevant contexts on performance and learning outcomes. Journal of Educational Psychology,105(4), 932.