iOS Apps for People with Intellectual Disability: A Quality Assessment

Andrés Larco[1], Freddy Enríquez[1] and Sergio Luján-Mora[2]
[1]*Departamento de Informática y Ciencias de la Computación, Escuela Politécnica Nacional, Quito, Ecuador*
[2]*Departamento de Lenguajes y Sistemas Informáticos, Universidad de Alicante, Alicante, Spain*

Keywords: iOS Apps, Intellectual Disability, Quality Assessment, Metrics Measurement.

Abstract: People with intellectual disability should have access to life-long learning opportunities that help them to acquire essential knowledge and skills. Due to poverty, they may be unable to access basic products and services such as telephones, television and the Internet. Unequal access to technology has created a digital divide. However, information and communication technology can help people with intellectual disability in the interaction with the external environment. The objective of this research was assessing iOS apps quality for people with intellectual disability using Mobile App Rating Scale. Apps included for evaluation needed to be educational, in Spanish and free to download. A systematic search was conducted with Preferred Reporting Items for Systematic Reviews and Meta-Analyses in Apple App Store, finding a total of 958 apps. After filtering, a total of 42 apps were considered for evaluation using Mobile App Rating Scale. The research identified seven apps with good quality, with scores over 4. Due to moderately correlation of subjective customer ratings of Apple App Store with Mobile App Rating Scale score, customer rating is an unreliable indicator of app quality. The results of this research can help therapists and parents to choose the right app for people with intellectual disability.

1 INTRODUCTION

Disability is the umbrella term for impairments, activity limitations and participation restrictions. Disability is the interaction between individuals with a health condition (e.g. cerebral palsy, Down syndrome and depression) and personal and environmental factors. About 15 % of the world's population, are estimated to live with some form of disability (World Health Organization, 2018).

Disability is a development issue, because it may increase the risk of poverty, and poverty may increase the risk of disability. A growing body of empirical evidence from across the world indicates that people with disabilities and their families are more likely to experience economic and social disadvantage than those without disability. Often, "types of disability" are defined using only one aspect of disability, such as impairments; sensory, physical, mental, and intellectual (World Health Organization, 2007, 2011).

The United Nations Organization for Education, Science, and Culture (UNESCO) estimates that more than 90 % of children with disabilities in developing countries do not attend school (UNICEF, 2015). Also, children with disabilities face discrimination and stigmatization about their capabilities.

In low and middle-income countries, between 76% and 85 % of people with severe mental disorders do not receive treatment. Also, the figure in high-income countries varies between 35 % and 50 %. The annual global expenditure on mental health is less than $ 2 per person and less than $ 0.25 per person in low-income countries. The problem is further complicated by the poor quality of care received (World Health Organization, 2013).

Intellectual disability is characterized by significant limitations in cognitive functioning and adaptive behavior. Cognitive functioning refers to general mental capacity, such as learning, reasoning, problem-solving, and so on. Adaptive behavior is the collection of conceptual, social, and practical skills that are learned and performed by people in their everyday lives (Schalock et al., 2010).

The point 25 of the 2030 Agenda for Sustainable Development of the United Nations pledges to "leave no one behind", by committing to provide inclusive and equitable quality education at all levels. All people, irrespective of sex, age, race or ethnicity, and

Larco, A., Enríquez, F. and Luján-Mora, S.
iOS Apps for People with Intellectual Disability: A Quality Assessment.
DOI: 10.5220/0006778602580264
In *Proceedings of the 10th International Conference on Computer Supported Education (CSEDU 2018)*, pages 258-264
ISBN: 978-989-758-291-2
Copyright © 2019 by SCITEPRESS – Science and Technology Publications, Lda. All rights reserved

persons with disabilities, migrants, indigenous peoples, children and youth, especially those in vulnerable situations, should have access to life-long learning opportunities that help them to acquire the knowledge and skills needed to exploit opportunities and to participate fully in society (United Nations, 2015).

Nevertheless, not all students have equal opportunities to access to Information and communication technology (ICT). Unequal access to ICT has created a digital divide (Wu, Chen, Yeh, Wang, and Chang, 2014). ICT can be important for people with intellectual disabilities. Previous research showed an evidence of the use of ICT focused on the main intellectual disabilities. For instance, people with Down syndrome need more support and stimulation than unaffected children to function independently. Therefore, to learn new skills, activities need to be broken down into smaller steps, and that more repetition and structure are required for retention (Felix, Mena, Ostos, and Maestre, 2017). Also, people with cerebral palsy often have motor impairment, so it is difficult for them to assist to school, and by using mobile apps, treatment can go anywhere with their devices (Griffiths and Addison, 2017). Multitouch tablets, including iPads, have made computing more accessible for a wide variety of populations. A previous research indicates that the simplicity of touch interactions and the portability of iPads have lowered the barriers for interacting with computers (Hourcade, Williams, Miller, Liang, and Huebner, 2013).

There are many app lists in stores, but most of them are in English and designed for iPad. Aside from the cost of the iPad itself, parents and therapists need to consider the cost of each application. Some iPad applications, including many games, are free (Boyd, Hart Barnett, and More, 2015). Research has shown that ratings with stars are subjective based on popularity, producing little or no meaningful information (Girardello and Michahelles, 2010), also, these qualifications may result to be an unreliable quality metric (Kuehnhausen and Frost, 2013). Besides that, it is not feasible to evaluate apps with software quality standards due to its extension, complexity and general purpose approach (González Reyes, André Ampuero, and Hernández González, 2015).

However, (Papadakis, Kalogiannakis, and Zaranis, 2017) present a Rubric for the Evaluation of Educational Apps for preschool Children (REVEAC) in four areas: contents, design, functionality, and technical quality, each having multiple aspects. Later, (Papadakis, Kalogiannakis, and Zaranis, 2018) examined educational apps for Greek preschoolers which have been designed in accordance with developmentally appropriate standards to contribute to the social, emotional and cognitive development of children in formal and informal learning environments. Another specific and reliable quality rate tool for mobile health apps is Mobile App Rating Scale (MARS) (Stoyanov et al., 2015).

A previous study provided a list of 73 Android apps for therapists and parents who work with people with Autism, Down syndrome, cerebral palsy and multiple disabilities (Larco, Yanez, Montenegro, and Luján-Mora, 2018). Also, an iOS apps evaluation was made (Larco, Enríquez, and Luján-Mora, in press) for people with Autism, Down syndrome, and cerebral palsy. REVEAC had a limitation to be applied to the present research, it is only focused on preschool education for children 4 to 6 years of age. Thus, MARS was chosen over REVEAC to assess app quality due to its width approach. Also, the research considered iOS again because apps which do not focus on a specific disability (in this case intellectual disability in general) were excluded from previous evaluation.

The objective of this research was assessing iOS apps quality for children with intellectual disability using MARS. Apps included for evaluation needed to be educational, in Spanish and free to download.

A total of 958 apps were initially identified, after applying Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), the remaining apps (42) were evaluated using MARS. The research identified seven apps with good quality, with scores over 4.

This paper is organized as follows. Section 2 describes some concepts discussed in the paper. Section 3 describes the systematic search performed with Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) and how MARS can be used to rate app quality. Section 4 describes the results and the relations found between MARS subscales. Then, section 5 discuss the results. Finally, section 6 presents conclusions and future work.

2 BACKGROUND

PRISMA is an evidence-based minimum set of items for reporting in systematic review and meta-analysis (Hutton, Catalá-López, and Moher, 2016). In the health scope, PRISMA has been used in apps searching to test the reliability of the MARS tool.

MARS is a rate tool for mobile health apps. The MARS demonstrated excellent internal consistency (alpha = .90) and interrater reliability intraclass correlation coefficient (ICC = .79) (Stoyanov et al., 2015). In this research, MARS was used to evaluate educational iOS apps quality. It was created in the health environment and contains five subscales:

- Engagement refers to fun, interest, customizable, interactive and target group.
- Functionality refers to functioning, ease of use, navigation, flow logic, and gestural design.
- Aesthetics refers to the graphic design, visual appeal, color scheme, and stylistic consistency.
- Information refers to high-quality information from a credible source.
- Subjective quality refers to user satisfaction.

MARS and PRISMA have been used in several researches. For instance, (Sullivan et al., 2016) identified, described the features, and rated the quality of smartphone apps that capture personal travel and dietary behavior and simultaneously estimate the carbon cost and potential health consequences of these actions. Apps were searched on Google Play and Apple App Store and out of 7213 results, 40 apps were identified and rated. Two researchers using MARS assessed the quality of included apps.

(Tinschert, Jakob, Barata, Kramer, and Kowatsch, 2017) assessed the potential of available mobile health apps, for improving asthma self-management. The Apple App store and Google Play store were systematically searched for asthma apps. In total, 523 apps were identified, of which 38 apps matched the selection criteria to be included in the final evaluation with MARS.

(Grainger, Townsley, White, Langlotz, and Taylor, 2017) assessed features and quality of apps to assist people to monitor Rheumatoid arthritis (RA) disease activity, by summarizing the available apps, particularly the instruments used for measurement of disease activity, and rating Apps quality with MARS. Of 71 Android apps retrieved from Google Play Store, 11 apps were included in MARS evaluation. Also, from 216 iOS apps gathered from New Zealand iTunes Store, 16 Apps were included for MARS evaluation.

Wikinclusion is a web knowledge base that contains software according to the competences of life for PWD. The education-based on competences brings attention to basic needs and develop different situations and social contexts in which a person is involved in his/her daily life (Bayardo, 2005). Wikinclusion defines seven competences of life: (1) autonomy, sensorimotor and social skills; (2) language and communication; (3) mathematics; (4) the social and natural environment; (5) digital competence; (6) artistic knowledge; and (7) transition to the labor market (Wikinclusion, 2017). In this research, in addition to carry out the quality evaluation with MARS, apps were classified according to its respective competence of life.

3 METHODOLOGY

3.1 Systematic Search Criteria and Selection

A systematic search using PRISMA was performed in Apple App Store. Apps were searched through a web page, appAkin, between September and October of 2017, using the terms 'children OR education OR puzzles' in Spanish. Inclusion criteria were: Spanish language, puzzle games, educational apps, and free to download.

PRISMA consists of a four-phase flowchart (Liberati et al., 2009). The first phase is identification, the second one is screening, the third one is eligibility, and the last one is included.

The exclusion criteria for identification phase were: paid apps, non-Spanish language apps, and duplicated apps. On screening phase, the exclusion criteria were: irrelevant content for children learning. On eligibility phase, the exclusion criteria were: not enough information, no longer available, no longer working and not available in Ecuadorian Apple App Store. On included phase, the remaining apps were downloaded and evaluated by testers using MARS.

3.2 Rating Tool

MARS was used to rate mobile apps, and it contains 23 items grouped by five subscales: engagement (5 items), functionality (4 items), aesthetics (3 items), information (7 items) and subjective quality (4 items). The average of the first four subscales determines the app quality score. MARS items use a Likert scale (1-Inadequate, 2-Poor, 3-Acceptable, 4-Good, 5-Excellent) (Masterson Creber et al., 2016).

A team of 14 testers performed the evaluation; each tester was assigned a minimum of three applications to evaluate. A template was created for data extraction following MARS scale. Inside the template, the first section contains app information; the second one contains app quality ratings, the third one contains subjective app quality, and the last one presents a summary of MARS subscales. Also, testers classified every app according to its respective competence of life. Training sessions for testers were performed about the process of how to evaluate apps using the templates. Included apps were evaluated on the following devices: iPhone 5s, iPhone 6, iPad 1, iPad Mini and iPad Air.

3.3 Data Analysis

ICC determined the interrater reliability of MARS subscales. The ICC form used in this research was a two-way mixed-effects model because the result only represents the reliability of the specific raters involved in the reliability experiment (Koo and Li, 2016). The confidence interval (CI) is a type of interval estimate that was computed from the observed data. The confidence level is the frequency of possible confidence intervals that contain the real value of their corresponding parameter. The most common confidence level is 95 % (Gupta, 2012). Pearson correlation coefficient is a measure between sets of data and how well they are related (Mukaka, 2012). Finally, data was analyzed using IBM SPSS Statistics 23.

4 RESULTS

A total of 958 apps were searched through appAkin choosing the filter "Free-Only". Irrelevant app categories such as Productivity, Apps, Lucky Charms, Cooking Recipes were excluded. Apps were searched with the terms intellectual disability, kids, education, education kids and puzzle. Apps were filtered through categories such as educational, education, family games and music for kids. Finally, 42 apps were included in the final evaluation. Fig. 1 shows the results of the search.

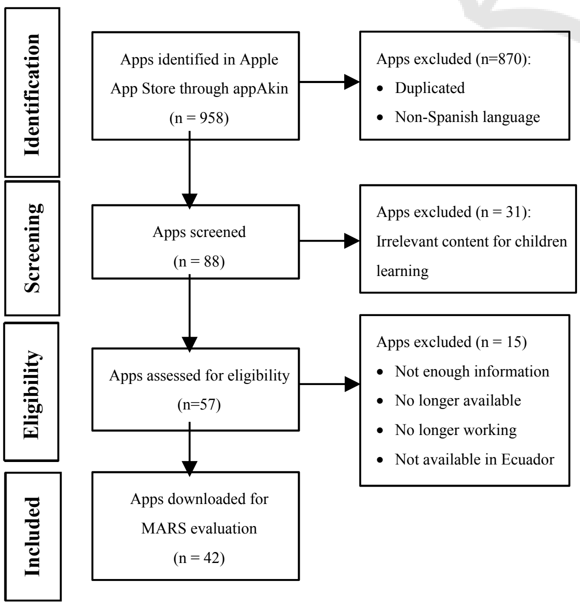

Figure 1: Systematic search of apps.

Table 1 contains apps grouped by its respective competence of life.

Table 1: Apps by competence of life.

Competence of life	App name
Autonomy, sensorimotor and social skills	Animal Train for Toddlers
	Animated Puzzle 1
	Animated Puzzle 2
	Animated Puzzle 3
	Build a Toy 1
	Build-it-up
	Chromville
	CI Niños
	Crazy Kitty Tap
	Dilo en señas
	Dot.2.Dot
	Families 1
	Find-It
	Fit Brains for Kids
	Match it up
	Matrix Game 1
	Opposites 1
	Patrones para Niños versión gratis
	Puzzle Me 1
	Puzzle Me 2
	Sorting Game
	Things to Learn
	What's Diff 2
Language and communication	Abecedario 1.0 G
	Busca la Letras Lite
	Dime paint lite
	Families 2
	Leo Con Grin
	My First Book of Spanish Alphabets
	NaturalReader Text to Speech
	NeoRom
	Piruletras
The social and natural environment	Adivina el animal versión Gratis
Mathematics	Kely Sumar y Restar
	Matemáticas con Grin
	Matemáticas con Grin II – 678
	Pop Math Lite
	Series 1
	Series 2
	Series 3
	Shapes Jigsaw
	Tikimates: multiplicar y dividir

SCITEPRESS SCIENCE AND TECHNOLOGY PUBLICATIONS

Table 2 contains MARS total score for each app, it was calculated based on engagement, functionality, aesthetics, and information.

Table 2: MARS scores for each app.

App name	MARS
Kely Sumar y Restar	4.53
Tikimates: multiplicar y divider	4.26
Busca la Letras Lite	4.21
Chromville	4.13
Series 1	4.13
Patrones para Niños - Versión Gratis	4.11
Dilo en señas	4.09
Crazy Kitty Tap	3.95
Families 2	3.87
Fit Brains for Kids	3.82
Find-It	3.66
Build-it-up	3.64
Build a Toy 1	3.63
Series 2	3.62
Animal Train for Toddlers	3.61
Opposites 1	3.61
Dot.2.Dot	3.59
Match it up	3.58
Series 3	3.51
Adivina el animal version Gratis	3.50
Dime paint lite	3.49
Things to Learn	3.46
NaturalReader Text to Speech	3.46
NeoRom	3.43
What's Diff 2	3.36
Shapes Jigsaw	3.36
Animated Puzzle 1	3.35
Animated Puzzle 3	3.35
Animated Puzzle 2	3.34
Puzzle Me 2	3.34
Puzzle Me 1	3.30
Families 1	3.29
Abecedario 1.0 G	3.29
Matrix Game 1	3.27
Pop Math Lite	3.15
Leo Con Grin	3.06
Sorting Game	3.00
Piruletras	2.97
Matemáticas con Grin II - 678	2.97
Matemáticas con Grin	2.97
CI Niños	2.42
My First Book of Spanish Alphabets	1.68

Table 3 contains the mean of the 23 items of MARS subscales for the 42 evaluated apps. Each subscale has its ICC, used to demonstrate the acceptable level of reliability among evaluators.

Item 19 "Evidence base" was excluded from all calculations, as it currently contains no measurable data (Stoyanov et al., 2015).

Table 3: Statistics of the 23 items of MARS.

Subscale/Item	Mean
Engagement ICC = 0.77 (95 % CI 0.63 - 0.86)	
1. Entertainment	3.69
2. Interest	3.55
3.Customization	2.55
4. Interactivity	2.52
5. Target group	3.88
Functionality ICC = 0.78 (95 % CI 0.65 - 0.87)	
6. Performance	4.07
7. Ease of use	3.81
8. Navigation	4.00
9. Gestural design	3.83
Aesthetics ICC = 0.84 (95 % CI 0.84 - 0.93)	
10. Layout	3.88
11. Graphics	3.74
12. Visual appeal	3.76
Information ICC= 0.63 (95 % CI 0.43 - 0.77)	
13. Accuracy of app description	3.95
14. Goals	2.93
Subscale/Item	Mean
15. Quality of information	3.12
16. Quantity of information	3.07
17. Visual information	3.36
18. Credibility	3.31
19. Evidence base	-
Subjective quality ICC= 0.94 (95 % CI 0.91-0.97)	
20. Would you recommend this app?	3.17
21. How many times do you think you would use this app?	3.57
22. Would you pay for this app?	3.29
23. What is your overall star rating of the app?	3.29

5 DISCUSSION

The apps searched needed to be in Spanish due to the target group. However, it can be noted that the name of several applications is in English, thus, language description of each app was carefully reviewed, and some apps were found with multilanguage content.

Despite the search criteria were in Spanish, the accuracy of the results was low due to the inadequate quality description of apps. Also, subcategories presented by appAkin contained several apps duplicated. Thus, 870 apps were dismissed of 958.

According to the MARS scale, seven apps of forty-two obtained a good quality (scores over 4), which means thirty-five apps were poorly designed, only good quality apps would be strongly recommended for their use by therapists, parents, and people with intellectual disability.

For autonomy, sensorimotor and social skills competence the best-rated app was Chromville (4.13), for language and communication competence, the best-rated app was Busca Las Letras Lite (4.21). Finally, for mathematics competence, the best-rated app was Kelly Sumar y Restar (4.53).

Apps with MARS score below 3 presented similar problems. Apps did not contain a settings section, functionality of the app was slow and broken in some parts (like buttons), the movement between screens (such as sliding) was also slow and lacks attraction. Same color for most of the content. Free content was limited, but the paid content was offered. The exactitude of item/options selection was low. Middle or low quality of the images or graphics within the app.

The best-rated subscale was functionality with a mean value of 3.93; the reason is on performance (4.07), navigation (4.00), gestural design (3.83) and ease of use (3.81) of the evaluated apps. On the other hand, the reason engagement had the lowest mean score (3.24) was a lack of customization (2.55) and interactivity (2.52) of the evaluated apps. The MARS total mean score of subscales had a good reliability (ICC = 0.79), which means there is a high consistency in measurements of MARS items made by testers.

Inside Apple App Store, every time developers release a new version of an app, the star rating provided by customers is deleted. As a result, customer ratings of Apple App Store were available on 67 % (28/42) of the evaluated apps. Customer ratings available on apps were moderately correlated with the MARS total score (Pearson correlation coefficient = 0.40).

6 CONCLUSIONS

Evaluated apps presented minor performance problems, and there was a lack of specific, measurable and achievable goals in the description of apps. The absence of customization and interactivity in free apps is due to the target group of Apple products is focused on people with a premium income level. Free apps have an absence of customization and interactivity this occurs due iOS developers focus their efforts to develop paid apps for people with a premium income level. These characteristics are important because they could improve the engagement of people with intellectual disability when using apps.

Due to moderately correlation of subjective customer ratings of Apple App Store with MARS score, customer rating is an unreliable indicator of app quality. It should not be considered because it is not focused on people with intellectual disability. However, the list of evaluated apps generated by this research can help therapists and parents to choose from the list the right app for people with intellectual disability avoiding the confused and independent search for apps due to the non-existence of store categorizations by disability type and app quality.

Also, the research identified which apps help to develop specific competences of life (such as autonomy, sensorimotor and social skills; language and communication; and mathematics) with the purpose of helping people with intellectual disability. The main competence for the evaluated apps was autonomy, sensorimotor and social skills (55 %) since it is essential for people with intellectual disability in their daily activities. Also, no apps were found for the competences artistic knowledge, digital competence and transition to the labor market.

It is incorrect to tag people with disabilities, therapists and parents of people with intellectual disability could use apps for kids because apps need to be focused on people with and without intellectual disability.

REFERENCES

Bayardo, M. G. M. (2005). Educación de calidad y competencias para la vida. *Revista Educar*, *35*, 25–32.

Boyd, T. K., Hart Barnett, J. E., and More, C. M. (2015). Evaluating iPad technology for enhancing communication skills of children with Autism Spectrum Disorders. *Intervention in School and Clinic*, *51*(1), 19–27.

Felix, V. G., Mena, L. J., Ostos, R., and Maestre, G. E. (2017). A pilot study of the use of emerging computer technologies to improve the effectiveness of reading and writing therapies in children with Down syndrome: Emerging computer tool for learning in children with DS. *British Journal of Educational Technology*, *48*(2), 611–624.

Girardello, A., and Michahelles, F. (2010). AppAware: Which mobile applications are hot? In *Proceedings of the 12th international conference on Human computer interaction with mobile devices and services* (pp. 431–434). ACM.

González Reyes, A., André Ampuero, M., and Hernández González, A. (2015). Análisis comparativo de modelos y estándares para evaluar la calidad del producto de software. *Revista Cubana de Ingeniería*, *VI*(3).

Grainger, R., Townsley, H., White, B., Langlotz, T., and Taylor, W. J. (2017). Apps for People with Rheumatoid Arthritis to Monitor Their Disease Activity: A Review of Apps for Best Practice and Quality. *JMIR MHealth and UHealth*, *5*(2), e7.

Griffiths, T., and Addison, A. (2017). Access to communication technology for children with cerebral palsy. *Paediatrics and Child Health*. Retrieved from http://linkinghub.elsevier.com/retrieve/pii/S1751722217301452

Gupta, S. K. (2012). The relevance of confidence interval and P-value in inferential statistics. *Indian Journal of Pharmacology*, *44*(1), 143–144.

Hourcade, J. P., Williams, S., Miller, E., Liang, L., and Huebner, K. (2013). Evaluation of Tablet Apps to Encourage Social Interaction in Children with Autism Spectrum Disorders. In *CHI 2013: Changing Perspectives* (pp. 3197–3206). Paris, France.

Hutton, B., Catalá-López, F., and Moher, D. (2016). La extensión de la declaración PRISMA para revisiones sistemáticas que incorporan metaanálisis en red: PRISMA-NMA. *Medicina Clínica*, *147*(6), 262–266.

Koo, T. K., and Li, M. Y. (2016). A Guideline of Selecting and Reporting Intraclass Correlation Coefficients for Reliability Research. *Journal of Chiropractic Medicine*, *15*(2), 155–163.

Kuehnhausen, M., and Frost, V. S. (2013). Trusting smartphone apps? To install or not to install, that is the question. In *2013 IEEE International Multi-Disciplinary Conference on Cognitive Methods in Situation Awareness and Decision Support* (pp. 30–37).

Larco, A., Enríquez, F., and Luján-Mora, S. (in press). *Review and evaluation of special education iOS Apps using MARS*. EDUNINE 2018.

Larco, A., Yanez, C., Montenegro, C., and Luján-Mora, S. (2018). Moving Beyond Limitations: Evaluating the Quality of Android Apps in Spanish for People with Disability. In *Proceedings of the International Conference on Information Technology & Systems (ICITS 2018)* (Vol. 721, pp. 640–649). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-73450-7_61

Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gotzsche, P. C., Ioannidis, J. P. A., … Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: explanation and elaboration. *BMJ*, *339*(jul21 1), b2700–b2700.

Masterson Creber, R. M., Maurer, M. S., Reading, M., Hiraldo, G., Hickey, K. T., and Iribarren, S. (2016). Review and Analysis of Existing Mobile Phone Apps to Support Heart Failure Symptom Monitoring and Self-Care Management Using the Mobile Application Rating Scale (MARS). *JMIR MHealth and UHealth*, *4*(2), e74.

Mukaka, M. M. (2012). A guide to appropriate use of correlation coefficient in medical research. *Malawi Medical Journal*, *24*(3), 69–71.

Papadakis, S., Kalogiannakis, M., and Zaranis, N. (2017). Designing and creating an educational app rubric for preschool teachers. *Education and Information Technologies*, *22*(6), 3147–3165. https://doi.org/10.1007/s10639-017-9579-0

Papadakis, S., Kalogiannakis, M., and Zaranis, N. (2018). Educational apps from the Android Google Play for Greek preschoolers: A systematic review. *Computers & Education*, *116*, 139–160. https://doi.org/10.1016/j.compedu.2017.09.007

Schalock, R. L., Borthwick-Duffy, S. A., Bradley, V. J., Buntinx, W. H. E., Coulter, D. L., Craig, E. M., … Yeager, M. H. (2010). *Intellectual Disability: Definition, Classification, and Systems of Supports. Eleventh Edition*. American Association on Intellectual and Developmental Disabilities.

Stoyanov, S. R., Hides, L., Kavanagh, D. J., Zelenko, O., Tjondronegoro, D., and Mani, M. (2015). Mobile App Rating Scale: A New Tool for Assessing the Quality of Health Mobile Apps. *JMIR MHealth and UHealth*, *3*(1), e27.

Sullivan, R. K., Marsh, S., Halvarsson, J., Holdsworth, M., Waterlander, W., Poelman, M. P., … Maddison, R. (2016). Smartphone Apps for Measuring Human Health and Climate Change Co-Benefits: A Comparison and Quality Rating of Available Apps. *JMIR MHealth and UHealth*, *4*(4), e135.

Tinschert, P., Jakob, R., Barata, F., Kramer, J.-N., and Kowatsch, T. (2017). The Potential of Mobile Apps for Improving Asthma Self-Management: A Review of Publicly Available and Well-Adopted Asthma Apps. *JMIR MHealth and UHealth*, *5*(8), e113.

UNICEF. (2015). *The Investment Case for Education and Equity Executive Summary*.

United Nations. (2015, October 21). Transforming our world: the 2030 Agenda for Sustainable Development.

Wikinclusion. (2017). Wikinclusion. Retrieved November 4, 2017, from http://wikinclusion.org/index.php/Página_principal

World Health Organization (Ed.). (2007). *International classification of functioning, disability and health: Children & youth version*. Geneva.

World Health Organization. (2011). *World report on disability*. Geneva: World Health Organization.

World Health Organization. (2013). *Mental Health Action Plan 2013-2020*.

World Health Organization. (2018). Disability and health. Retrieved January 27, 2018, from http://www.who.int/mediacentre/factsheets/fs352/en/

Wu, T.-F., Chen, M.-C., Yeh, Y.-M., Wang, H.-P., and Chang, S. C.-H. (2014). Is digital divide an issue for students with learning disabilities? *Computers in Human Behavior*, *39*, 112–117.