Study on Digital Visual Support Intervention: A Review of The Influence of Engagement and Motivation on Students with Autism

Tharishni Anblagan, Nor Aniza Ahmad, Samsilah Roslan

Department of Foundations of Education, Faculty of Educational Studies, Universiti Putra Malaysia, 43400 Serdang, Selangor

Abstract
Technology has been receiving much attention in special education, resulting in visual support being used as an intervention tool among students with autism spectrum disorder. A digital visual support intervention is introduced as a visual representation to aid independence when completing a series of tasks. Students' motivation and engagement during the task are further examined during the task. This paper proposes a review of the influence of engagement and motivation on digital visual support interventions. The researcher will employ Design and Development Research (DDR) with three respective phases: a) Need Analysis Phase; b) Design and Development Phase; and c) Evaluation Phase. The expected outcome of this study will benefit the autism students, educators, researchers, and policymakers for future research in the field of special education intervention.
Keywords: Digital Visual Support, Autism, Motivation, Engagement, Intervention

Introduction
A growing body of emerging technology in special education offers new insights in the field of special education (Vuorikari et al., 2020). The Joint Research Centre in Europe mentioned that technology involving robots will benefit students with autism spectrum disorder. Similarly, the third Shift in the Malaysian Education Plan from 2021 to 2025 mentioned that Information and Communication Technology (ICT) to be introduced to the special education needs group to achieve a continuously high learning standard in school (Ministry of Education, 2013).

While both global and the local context has emphasized to take technology seriously in educating students with special needs but there is still exist a gap to the filled in. What is more concerning is the data obtained from the Special Education Division suggest that the biggest category of students in the special education setting are autism spectrum disorder (Ministry of Education, 2020). The recent data also revealed an increasing trend on the total autism preschool students with a total of 658 students in year 2022 from 537 students in year 2021

(Ministry of Education, 2020; 2021). Thus, an appropriate intervention on improving their engagement and motivation to cater to this autism spectrum students are recommended.

One of the interventions is visual support, which helps students with autism spectrum disorder process the given information easier and faster than without any support. This visual support intervention is more common in the evidence base supporting services for transition from school to adulthood (Stuart & Collins, 2019), but very little is known about visual support at the preschool level. Although the TEACCH (Treatment and Education of Autistic and Related Communication Handicapped Children) Program was introduced in Perak State in 2014, the visual aids used are labelled "*bahan bantu mengajar*," or teaching aids, unlike visual support. Furthermore, the TEACCH programme mainly focused on academic skills in the classroom (Bakar et al., 2020). Another study continues to debate how conceptual skills (25.53%) are more focused than other skills like practical skills. Surprisingly, living skills are the least studied, with a total of 8.51% (Valencia et al., 2019). Thus, this study will address the living skills in self-management that are so far lacking in the scientific literature.

Although the present intervention tools, such as digital visual schedules, static pictures, and video prompting, have appeared to increase motivation and engagement, there is still little study on the digital visual support (Kellems et al., 2018; Rani et al., 2016; Simeoli et al., 2019). Recent digital applications such as AutiAct and AutiTEACCH are introduced among caregivers to test the usability of daily life skills among target users (Ahmad & Zulkharnain 2020; Shminan et al. 2020). Findings shows positive effect on the usefulness of the application but what is more important is the application of the skills on the students with autism spectrum disorder to study its effect is a key component in the classroom setting.

This work aims to review the influence of engagement and motivation on digital visual support intervention based on prior research.

Literature Review
This section highlights the summary of literature of how each dependent variable (engagement and motivation) influences the digital visual support intervention.

Digital Visual Support
Research has reported to focus on visual support rather than digital visual support. Visual support is defined as a visual representation of information for better comprehension (Rutherford et al, 2020). This additional visual cue will encourage students with autism to learn a desired behaviour or skill without prompting. Some examples of visual supports are pictures, written words, items in the environment, the arrangement of the environment or visual borders, timetables, maps, labels, organising systems, and timeline (Barczak, 2020). In the modern information era, digital application can be accessed through different types of devices. For instance, computers, smartphones, and tablets are commonly used. Mobile assistive application focused on social, communication and behavioural skills are gaining more attention in western countries (Escobedo et al., 2012; Babb et al., 2021; Babcock, 2020; Solano et al., 2020).

Similarly, in recent years there has been growing interest in the local context on the mobile-based application. What we know about mobile application using visual are taught in a variety of abilities, including numeracy and communication skills (Ahmad & Zulkharnain, 2020; Kamaruzaman et al., 2016). Communication skill has been identified to be a priority among

the visual support research both globally and locally. Other skills like life skills are targeted but among older autism students in the middle school or older adults with autism spectrum disorder (Kellems et al., 2018; Pérez-Fuster et al., 2019). One question that need to be raised is the reason living skills are targeted as a mobile learning platform to autistic children caregiver, instead or taught directly to the student.

To fill this literature gap, this paper introduces specifically selected self-management skills with reference to the *Kurikulum Standard Prasekolah Kebangsaan Pendidikan Khas* (KSPK PK), upon interviewing preschool special education teachers to identify the need for a digital visual support. After designing using an existing digital application, the components of the living skills will be reviewed by experts in the field. Upon completion, this digital visual application will be tested on the student with autism spectrum disorder. Through this digital visual support intervention, it is expected that the digital treatment group will influence the motivation and engagement of the student with autism.

Student Engagement in Classroom
Engagement was first described as "time on task" (Newmann, 1986). In recent years, there has been a growing interest on engagement which comes in two main sources of research in this area, which is the general education literature and the disability literature (Keen et al., 2011). There are three main components which divides engagement which is the cognitive, emotional, and behavioural. Cognitive engagement encourages students to have the willingness and new mastery of skills while emotional engagement refers to student interest in each activity. Behavioural engagement targets on the involvement of the student in an educational activity (Fredericks et al., 2004). However, previous studies draw our attention to focus on the behavioural engagement among early years in the classroom.

Research has focused on rating scales to measure engagement among students. Since preschool students are too young to complete self-report instruments themselves, past research has introduced various instruments to measure engagement among students (Christenson et al, 2012). For instance, the Teacher Engagement Report Form-New (TERF-N) is used to measure student engagement (Hart et al., 2011). There are all three components in this scale, which are cognitive, behavioural, and affective engagement, as rated by the teacher. It was argued that the Student Engagement in Schools Questionnaire (SESQ), which is a student self-measure scale with 109 items to answer compared to only 10 items in TERF-N. The key problem in the literature regarding student engagement is whether a multidimensional (cognitive, behaviour and emotional) model is essential to measuring student engagement or if it would create further confusion in the field.

Additionally, digital applications when utilised in school can be further justified with observation and documentation when measuring the effect of engagement on autism spectrum students (Hong et al., 2021). To support the findings of engagement in this study, questionnaires will be used to measure the student engagement among preschoolers with autism. However, the existing research has many problems in representing the type of method used to measure student engagement. Is questionnaire not sufficient to measure student engagement? Further studies should be explored before deciding on how to measure this construct.

Student Motivation in Classroom

In the past two decades, both intrinsic and extrinsic motivation have received considerable attention in student motivation (Deci & Ryan, 2017). When a student has a natural interest in and enjoys what he or she does, this is an example of intrinsic motivation. Furthermore, the same student will complete the task "for their own sake," resulting in the student feeling joyful and satisfied (Deci & Ryan, 2000). Extrinsic motivation, on the other hand, focuses on conduct carried out for a specific cause (Deci & Ryan, 2020). This is very common among students with autism spectrum disorder. More work is necessary when technology is introduced in motivation. However, careful consideration needs to be given to the fact that motivation comes from the completion of the task and not from the use of digital devices themselves.

There is a diagnostic tool that is available, such as the Child Behaviour Motivation Scale (CBeMO) (Lepola et al., 2007). This scale measures social dependence, task avoidance, and task orientation when the teacher rates the preschool student. Others use motivational instruction in the mobile application to motivate students in the classroom (Bruhn et al., 2017). Three components of challenge, context, and control are suggested. The author further explained that instruction that challenges students the best is when tasks are matched to their abilities, allowing choice, encouraging self-management, and assisting students to conceptualise learning through background information. Interestingly, with the rise of mobile technology, applications can now be employed as a delivery method for various instructional materials.

Autism and motivation have some positive aspects. Application of game features uses motivation among typically developing student (Alsawaier, 2018). When interactive digital games are involved among autism students, their motivation significantly improves during the game. A local study found motivation among students with autism spectrum disorder differs depending on the location of their school, either rural or urban (Rani et al., 2016). Therefore, using tablets and computers in class could be very helpful for teaching student with autism, given that technology can enhance the students' motivation and help maintain their focus (Patchan & Puranik, 2016). More future work needs to be done to relate digital visual support to motivation.

Discussion and Conclusion

In conclusion, students with autism spectrum disorder are more likely to encounter problems when completing a functional skill. With the use of visual support in the form of visual representation, students with autism will be able to be independent and engage in completing a series of tasks. Students with autism can also learn skills in a fun way using technology, unlike the traditional printed material that is used by teachers in the classroom. The digital visual support intervention is also seen as useful to motivate the student with autism spectrum disorder in the classroom setting. This visual aid will be a medium for transferring written knowledge content into visual form. The reward system introduced will motivate the student to complete a functional skill. This has been a struggle for teachers teaching students with autism spectrum disorder. This intervention is also expected to encourage engagement among students with autism spectrum disorder emotionally, behaviourally, and cognitively.

This research adds to previous research by showing the contribution of motivation and engagement to the field of knowledge and bringing benefit to others. This study is crucial because it will significantly benefit the Malaysian Ministry of Education, teachers, particularly preschool special education teachers, students with autism spectrum disorder and their parents, researchers, policymakers, and professionals in a variety of fields, including psychologists, occupational therapists, speech therapists, interventionists, audiologists, and physiologists. This will also encourage school-based intervention support.

Corresponding Author
Nor Aniza Ahmad
Department of Foundation of Education, Faculty of Educational Studies, Universiti Putra Malaysia
Email: nor_aniza@upm.edu.my

References
Ahmad, W. F. W., & Zulkharnain, N. A. B. (2020). Development of a mobile application using augmentative and alternative communication and video modelling for autistic children. *Global Business & Management Research*, *12*(4).

Alsawaier, R. S. (2018). The effect of gamification on motivation and engagement. *International Journal of Information and Learning Technology*, *35*(1), 56–79. https://doi.org/10.1108/IJILT-02-2017-0009

Babb, S., McNaughton, D., Light, J., & Caron, J. (2021). "Two friends spending time together": The impact of video visual scene displays on peer social interaction for adolescents with autism spectrum disorder. *Language, speech, and hearing services in schools*, *52*(4), 1095-1108.

Babcock, S. (2020). *Using Video Modeling to Teach Social Skills to Students with Disabilities*. Doctoral dissertation, University of Georgia.

Bakar, N. H. A., Yusof, F. H. M., & Abd Hamid, M. (2020). Implementation of Teach Programs in The Mathematical Pedagogy to The Students with Autism. In *International Conference on Special Education In South East Asia Region 10th Series 2020* (pp. 306-316). Redwhite Press.

Barczak, M. A. (2020). *Using visual supports to teach vocational skills to students with significant intellectual disabilities*. Doctoral thesis, The Ohio State University.

Bruhn, A., Hirsch, S., & Vogelgesang, K. (2017). Motivating Instruction? There's an App for That!. *Intervention in School and Clinic*, *52*(3), 163-169.

Christenson, S., Reschly, A. L., & Wylie, C. (2012). *Handbook of research on student engagement* (Vol. 840). New York: Springer.

Escobedo, L., Nguyen, D. H., Boyd, L., Hirano, S. H., Rangel, A., García-Rosas, D., ... & Hayes, G. R. (2012). MOSOCO: A Mobile Assistive Tool to Support Children with Autism Practicing Social Skills in Real-Life Situations.

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research*, *74*(1), 59-109. http://dx.doi.org/10.3102/00346543074001059

Fredricks, J. A., Reschly, A. L., & Christenson, S. L. (Eds.). (2019). *Handbook of student engagement interventions: working with disengaged students*. Academic Press. https://doi.org/10.1016/C2016-0- 04519-9

Hart, S. R., Stewart, K., & Jimerson, S. R. (2011). The student engagement in schools questionnaire (SESQ) and the teacher engagement report form-new (TERF-N): Examining the preliminary evidence. *Contemporary School Psychology: Formerly" The California School Psychologist"*, *15*(1), 67-79.

Hong, J.-C., Chuang, C.-Y., & Sher, Y. (2021). Effects and motivation/engagement of an interactive digital game for special education students in elementary school: A case study analysis. *Journal of Rehabilitation Practices and Research*, *2*(1), 1–14. https://doi.org/10.33790/jrpr1100118.

Kamaruzaman, M. F., Nor, H. M., & Azahari, M. H. H. (2016). Using touchscreen technology to support basic numeracy learning process for high functioning children with autism. *Turkish Online Journal of Educational Technology*, *2016* (7), 632–639.

Keen, D., Pennell, D., Muspratt, S., & Poed, S. (2011). Teacher self-report on learner engagement strategies in the early years classroom. *Australian Educational Researcher*, *38*(3), 293–310. https://doi.org/10.1007/s13384-011-0029-5

Kellems, R. O., Frandsen, K., Cardon, T. A., Knight, K., & Andersen, M. (2018). Effectiveness of static pictures vs. video prompting for teaching functional life skills to students with autism spectrum disorders. *Preventing School Failure*, *62*(2), 129–139. https://doi.org/10.1080/1045988X.2017.1393790

Kientz, J. A., Hayes, G. R., Goodwin, M. S., Gelsomini, M., & Abowd, G. D. (2019). Interactive technologies and autism. *Synthesis lectures on assistive, rehabilitative, and health-preserving technologies*, *9*(1), i-229.

Lepola, J., Mattinen, A., & Salonen, P. (2007). Child behavior and motivation rating scale in adult-guided crafts and activity situations in a day-care center.

Ministry of Education. (2013). *Special Education Data 2019 Malaysia Education Blueprint 2013-2025 (Preschool to Post-Secondary Education)*. Putrajaya: Ministry of Education Malaysia.

Ministry of Education. (2020). *Special Education Data 2020*. Putrajaya: Ministry of Education Malaysia.

Ministry of Education. (2021). *Special Education Data 2020*. Putrajaya: Ministry of Education Malaysia.

Newmann, F. M. (1986). Priorities for the future: Toward a common agenda. *Social Education*, *50*(4), 240-250.

Patchan, M. M., & Puranik, C. S. (2016). Using tablet computers to teach preschool children to write letters: Exploring the impact of extrinsic and intrinsic feedback. *Computers & Education*, *102*, 128–137. https://doi.org/10.1016/j.compedu.2016.07.007

Pérez-Fuster, P., Sevilla, J., & Herrera, G. (2019). Enhancing daily living skills in four adults with autism spectrum disorder through an embodied digital technology-mediated intervention. *Research in Autism Spectrum Disorders*, *58*, 54–67. https://doi.org/10.1016/j.rasd.2018.08.006.

Rani, N. M., Ramli, S. H., Legino, R., Azahari, M. H. H., & Kamaruzaman, M. F. (2016). Comparative study on the engagement of students with autism towards learning through the use of mobile technology based visual schedule.

Rutherford, M., Baxter, J., Grayson, Z., Johnston, L., & O'Hare, A. (2020). Visual supports at home and in the community for individuals with autism spectrum disorders: A scoping review. *Autism*, *24*(2), 447-469.

Ryan, R. M., & Deci, E. L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology*, *25*(1), 54-67.

Ryan, R. M., & Deci, E. L. (2017). Self-determination theory: Basic psychological needs in motivation, development, and wellness. New York: Guilford.

Ryan, R. M., & Deci, E. L. (2020). Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions. *Contemporary Educational Psychology*, *61*, 101860.

Shminan, A. S., Choi, L. J., & Sharif, S. (2020). AutiTEACCH: Mobile-based Learning in a Structured Teaching Approach for Autistic Children Caregivers. In *2020 International Conference on Informatics, Multimedia, Cyber and Information System (ICIMCIS)* (pp. 259-264). IEEE.

Simeoli, R., Arnucci, M., Rega, A., & Marocco, D. (2019). A comparison between digital and traditional tools to assess autism: Effects on engagement and performance. *CEUR Workshop Proceedings*, *2524*.

Solano, A. (2020). Bridging Communication Deficits in Preschool Children Diagnosed with Autism Spectrum Disorder, a Review of Literature in Technology Aided Instruction and Intervention. [Doctoral Dissertation, Alliant International University]. *ProQuest Dissertations and Theses*, 111.

Stuart, S., & Collins, J. C. (2019). Special education transition services for students with autism. In *Special Education Transition Services for Students with Disabilities* (Vol. 35, pp. 99-116). Emerald Publishing Limited.

Valencia, K., Rusu, C., Quinones, D., & Jamet, E. (2019). The impact of technology on people with autism spectrum disorder: A systematic literature review. *Sensors (Switzerland)*, *19*(20), 1–22. https://doi.org/10.3390/s19204485

Vuorikari, R., Punie, Y., & Cabrera Giraldez, M. (2020). Emerging technologies and the teaching profession: Ethical and pedagogical considerations based on near-future scenarios.