

ASSESSING ASSISTIVE LEARNING TECHNOLOGIES WITH EXPERIMENTAL DESIGN

Gede P.^{1, a}, Muhammad S.², Helmi Adly M.N.³, Aliza C. E.¹, and Siti Nur Azreen R.¹

¹ Universiti Teknikal Malaysia Melaka

² Universitas AMIKOM-Yogyakarta

³ Malaysian Institute of Industrial Technology, Universiti Kuala Lumpur

ABSTRACT

Assistive learning technologies are computer-based tools that are aimed at assisting people with disabilities in improving their learning with minimum intervention of parents, caregivers, or helpers. Trials using experimental research design have largely been employed in order to assess their efficacy and feasibility. An experimental design is characterized by treatment or experimental units to be used, the way treatments are assigned to the units, and the responses that are measured. The treatment or experimental units require adequate number of and representative participants or sample. However, because of the limited numbers of participants or sample units, such kinds of studies have been noted as delicate but challenging experiences.

Keywords: assistive learning technology; disabilities; experimental design

1. INTRODUCTION

Assistive technologies (AT) are generally defined as "items, pieces of equipments, or product systems, whether acquired commercially, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities" [2]. Assistive learning technologies consist of, but not limited to, computer-based products that aim to assist disabled people in improving their learning with minimum caregivers' intervention. Further studies in the similar domain reported that more than eight in ten published studies on AT were conducted to investigate the efficacy of the use of AT in impacting participants' cognitive skills and, approximately, 50 per-cent of them employed experimental research design [1].

The trials for AT efficacy using experimental design were unique, delicate and challenging experiences [3] [9]

[7] since the participants of the trials are people with disabilities, such as those are with Autism Spectrum Disorder (ASD) or with partial strokes. Furthermore, researchers have experienced with several problems related with gaining access, parent or caregiver concern or permission, legal issues, and reporting the findings [4] [6]. In the next following parts of the paper, experiences or attempts are reported based on two selected trials of assistive learning technologies, which are an arithmetics tutor, called as MathTutor, and a serious game diagnosis, called as Vi-Per Games, for children with ASD.

Math Tutor Trial

This study is to investigate the efficacy of a computer as-sisted instruction or tutor in helping students with autism to learn elementary concepts of arithmetics. For this purpose, two independent sample pretest and post-test design of experiment was attempted and was targeted for children with ASD in the country of Malaysia. The design can be depicted by the Table 1 as follows.

Table 1. Experimental Design 1

O ₁	P	O ₂
O ₃	X	O ₄

However, since problems related with gaining legal access, concerns or permission from caregivers or parents, only a small number of participants can be obtained, particularly from states of Melaka and Perak. During the experiment, an informal observation was carried out on both control and experiment groups. Observers took notes on participants' attempts in using the tutor. Furthermore, notes were recorded from the observations pertaining to their behavior, progress, and if they had required guidance or assistance.

Vi-Per Games Trial

The study is aimed at investigating whether a set of serious games, called Vi-Per Games, can be used to diagnose severity of visual perception amongst children with ASD. In order to overcome problems related with history bias, which was the main inherent deficiency in the design, Tuckman [8] the one group pre-test and post-test was applied three times. The term history bias refers to the preconception triggered by events occurring in the environment concurrently when the experimental variable is being tested. The modified design, which was adapted by Pramudya [5], is called as separate-sample pre-test and post-test design. It is depicted in Table 2.

The results from the experiment indicate that there were no significant differences between participants' measures in pre-test and the post-test. It shows that, in each of the three samples, the participants' pre and post-test measures were the same. As the collection of game scores

Table 2. Experimental Design 3

O ₁	X	O ₂		
	O ₃	X	O ₄	
		O ₅	X	O ₆

was performed in three different independent samples and on different timelines, the history bias in this study was avoided. In other words, it is unlikely that some other events would have occurred simultaneously to affect the use of the serious game environment in the three samples. This supports the conclusion that the scores resulting from the use of the serious games are accurate. This suggests that the serious game approach by using Vi-Per Games as a promising alternative method may benefit caregivers or others in order to diagnose severity of visual perception amongst autistic children.

2. CONCLUSION

This is to review researcher experiences on employing design of experiment in two independent studies. The studies were aimed at investigating the efficacy of two assistive learning technologies, named MathTutor and Vi-Per Games, in helping children with ASD to learn elementary arithmetics concepts and assisting caregivers to diagnose severity of visual perception amongst children with ASD. Representative samples were designed in order to meet the external validity of the design or in attempts to generalize findings. However, because of the limited concern from the parents or caregivers as well as limited access gained, only small numbers of children with ASD participated. Therefore, the researchers had to shift the paradigm, scope, and data analysis of the studies.

3. REFERENCES

- [1] Alper, S., & Raharinirina, S. (2006). Assistive technology for individuals with disabilities: a review and synthesis of the literature. *Journal of Special Education Technology*, 21, 47-64.
- [2] Dell, A. G. D., Newton A., & Petro, J. G. (2012). *Assistive Technology in the Classroom: Enhancing the School Experiences of Students with Disabilities*. Boston: Allyn & Bacon.
- [3] Itzhak, E. B., & Zachor, D. A. (2011). Who benefits from early intervention in autism spectrum disorders? *Research in Autism Spectrum Disorder*, 5, 345-350.
- [4] Mann, W. C., Ottenbacher, K. J., Fraas, L., Tomita, M., & Granger, C. V. (1999). Effectiveness of assistive technology and environmental interventions in maintaining independence and reducing home care costs for the frail elderly: a randomized controlled trial. *Arch Fam Med*, 8, 210-217.
- [5] Pramudya, G. (2004). *Using an Adaptive Web-Based Learning Environment to Develop Conceptual and Procedural Knowledge* (Unpublished doctoral dissertation). University of Wollongong, Australia.
- [6] Robins, B., Dautenhahn, K., Boekhorst, R., & Billard, A. (Eds.). (2004). *Proceeding of the 2004: IEEE International Workshop on Robot and Human Interactive Communication*.
- [7] Tincani, M., Travers, J., & Boutot, A. (2009). Race, culture, and autism spectrum disorder: understanding the role of diversity in successful educational interventions. *Research & Practice for Persons with Severe Disabilities*, 34, 82-90.
- [8] Tuckman, B.W. (1994). *Conducting Educational Research*. Florida: Harcourt Brace & Co.
- [9] White, S. W., Keonig, K., & Scahill, L. (2007). Social skills development in children with autism spectrum disorders: a review of the intervention research. *Journal of Autism and Developmental Disorders*, 37, 1858-1868.