ASSESSING ASSISTIVE LEARNING TECHNOLOGIES WITH EXPERIMENTAL DESIGN

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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 e cacy 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 capabil-ities of individuals with disabilities" [2]. Assistive learn-ing technologies consist of, but not limited to, computer-based products that aim to assist disable people in improv-ing 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 e cacy 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 e cacy using experimental design were unique, delicate and challenging experiences [3] [9]

[7]since the participants of the trials are people with dis-abilities, such as those are with Autism Spectrum Disorder (ASD) or with partially strokes. Furthermore, researchers have experienced with several problems related with gain-ing access, parent or caregiver concern or permission, le-gal 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 learn-ing technologies, which are a arithmetics tutor, called as MathTutor, and a serious game diagnosis, called as Vi-Per Games, for children with ASD.

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Math Tutor Trial

This study is to investigate the e cacy of a computer as-sisted instruction or tutor in helping students with autism to learn elementary concepts of arithmetics. For this pur-pose, 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

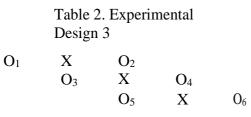
 $\begin{array}{ccc} O_1 & P & O_2 \\ O_3 & X & O_4 \end{array}$

However, since problems related with gaining legal ac-cess, concerns or permission from caregivers or parents, only a small number of participants can be obtained, par-ticularly from states of Melaka and Perak. During the experiment, an informal observation was carried out on both control and experiment groups. Observers toke 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 se-rious games, called Vi-Per Games, can be used to diag-nose 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 de-sign, 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 envi-ronment 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 di erences between participants' mea-sures in pre-test and the post-test. It shows that, in each of the three samples, the participants' pre and post-test mea-sures were the same. As the collection of game scores



was performed in three di erent independent samples and on di erent timelines, the history bias in this study was avoided. In other words, it is unlikely that some other events would have occurred simultaneously to a ect 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 de-sign of experiment in two independent studies. The stud-ies were aimed at investigating the e cacy of two assis-tive learning technologies, named MathTutor and Vi-Per Games, in helping children with ASD to learn elemen-tary arithmetics concepts and assisting caregivers to diag-nose 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 con-cern from the parents or caregivers as well as limited ac-cess gained, only small numbers of children with ASD participated. Therefore, the researchers had to shift the paradigm, scope, and data analysis of the studies.

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