Assisting students with autism to cooperate with their peers to perform computer mouse collaborative pointing operation on a single display simultaneously

Ching-Hsiang Shih [a,*], Ming-Shan Chiang [a], Ching-Tien Shih [b]

[a] Department of Special Education, National Dong Hwa University, Hualien, Taiwan, ROC
[b] Department of Digital Game & Animation Design, Tung Fang Design Institute, Kaohsiung City, Taiwan, ROC

A B S T R A C T

The purpose of this study was to provide students with autism spectrum disorder (ASD) the chance to cooperate with their peers to perform computer mouse collaborative pointing operation. In this study, we adopted the Single Display Groupware (SDG) concept to develop the Multiple Cursor Collaborative Operating Program (MCCOP) software, which allows multiple users to operate a single computer simultaneously without interfering with each other. With the implementation of MCCOP software, users control their own cursors to perform a function in their respective cursor moving areas on a single display. A collaborative pointing test software (CPTS) program was designed in this experiment to evaluate participants' collaborative pointing performance. This study adopted an ABAB design, and the experimental results show that all participants significantly increased their collaborative pointing performance during the intervention phase, compared to the baseline phase. Practical and developmental implications of the findings are discussed.

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1. Introduction

Affected individuals lacking social interaction is one characteristic of autism spectrum disorder (Lord & Bishop, 2010). Many individuals with ASD have trouble engaging in daily social interactions and building relationships with others. Researchers propose that social strategies such as group play and situation simulation may successfully help individuals with ASD improve their social interactions (Channon, Collins, Swain, Young, & Fitzpatrick, 2012; Tomaino, Miltenberger, & Charlop, 2014).

The development of computers continues to make life easier and more convenient. Many tasks can be completed by a computer, such as word processing, communication, providing entertainment, etc. The revolution of computer technology is also indirectly changing education, as computer applications in educational settings become ever broader and more various. There have been many examples of applying computers to education, including pedagogical techniques such as self-learning,

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* Corresponding author at: Department of Special Education, National Dong Hwa University, Hualien 970, Taiwan, ROC. Tel.: +886 3 8634881; fax: +886 3 8634870.
E-mail address: schee@mail.ndhu.edu.tw (C.-H. Shih).

computer assisted instruction (CAI), and game-based teaching. The generalization of computers increases the number and type of applications related to learning and teaching in education (Nickerson & Zodhiates, 2013).

Individuals with autism are often attracted by computer games which are full of variously visual and auditory stimuli (Mazurek & Wenstrup, 2013). Using computer games to assist children with ASD to learn may be a good strategy due to the possibility that the stimuli provided by such games will increase the children's learning motivation. Making good use of interactive computer games to promote language learning, social interaction and cognition for children with autism may lead them to more successfully adapt to social life (Hopkins et al., 2011; Rahman, Ferdous, & Ahmed, 2010).

Take "whack-a-mole" (TechRadium, 2014) as an example. This popular computer game, shown in Fig. 1, is easy to play and can be enjoyed by members of all generations. When the game starts, moles will come out from holes randomly, a player must move the cursor and click the moles; meanwhile, the tally of successful clicks is automatically recorded and this score is shown on the screen at the same time.

The computer game "whack-a-mole" is designed for a single user to play, and does not allow simultaneous multiple player use due to the Windows Operating System (OS) only supporting one cursor to operate a computer. When multiple mice connect to one computer, interference will occur due to any and all pointing devices connecting up to one cursor.

Single Display Groupware (SDG) is a software technology which is proposed to enable co-present users to collaborate through a single, shared display, and allows multiple input devices to be used simultaneously (Stewart, Bederson, & Druin, 1999). Studies have shown that it is effective to complete a task through a shared computer with multiple users using their own mice (Stanton, Neale, & Bayon, 2002).

With the application of the SDG technique, multiple cursors can be displayed on screen to allow multiple users to independently control their own cursors' movement, and while in a status of co-present collaboration, users can achieve the goal of working/playing together. As shown in Fig. 2, two cursors with different colors and corresponding name prompts, Mark and Jenny, are displayed on screen. Two individuals (Mark and Jenny) each have their own mice which they can use to control their respective cursors simultaneously without interfering with each other.

Fig. 1. "Whack-a-mole" is a computer game in which players click a mouse to hit moles which come out from holes randomly (TechRadium, 2014).
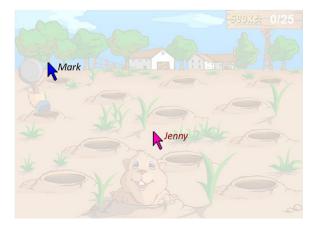

Fig. 2. Two cursors in different colors with name prompts are displayed on screen, and these two cursors can be independently controlled without interference occurring. (For interpretation of the references to color in figure legend, the reader is referred to the web version of the article.)