A Usability Evaluation of Visual Perception Game-Based Training System Design: A Case Study of Children with Developmental Delays

Cai-Ying Cheng and Yang-Cheng Lin

ABSTRACT: According to research reports, children under the age of 5 have a developmental delay rate of 10-15%, most often in preschoolers. Developmental delays cause children to lag behind in language comprehension, gross motor and selfcare skills, with visual impairment being one of the most common conditions in children with developmental delays. Visual perceptual skills play an important role in learning, gaming skills and daily life, and today's training methods are mainly based on traditional paper-based training. Visual perceptual skills play an important role in learning, gaming skills and daily life, and today's training methods are mainly based on traditional paper-based training. This method is boring and lack of interaction, which makes children lack of motivation to train and inattentiveness. The application of game training to children's medical care has been studied to a certain extent, and interactive game training has been effective in enhancing children's motivation to train. However, the situation is different for children with developmental delays. In addition to the interactive nature of the game, the system interface design will also affect the ease and usability of the training, so the interface design is most suitable for children with developmental delays and still needs to be explored.

The purpose of this study is to design a visual-perceptual game training system for children with developmental delays and to investigate their preferences for interface design and usability in order to design a highly satisfying training system. In this study, 16 children with preschool developmental delays (aged 4-7 years, mean age 5.5 years) were recruited to participate in an interface preference experiment. An eye-tracking device was used to observe the children's reading patterns during the experiment. The results of this study are: the position of the specified pattern placement had a significant effect on the number of correct answers of the children ($t=2.764$, $p=0.007<0.05$). Furthermore, an interface with a reward mechanism and a specified pattern in the center of the screen can help children's performance. Through the observation of the heat map, it was found that the children performing well in this system were more focused on the specified patterns and correct answers, while the children performing poorly were more scattered in their attention. Based on the above experimental results and the recommendations of the heuristic evaluation, the system was optimized and modified. Finally, 50 preschoolers (25 children with developmental delays and 25 children with typical development)were recruited for the system usability survey(SUS) and satisfaction survey. The results show that both groups

achieved an usability grade of B (80.8 and 85.7 for each), with a satisfaction rating of 4.48 and 4.84 out of 5. The results show that the system is simple and easy to use for both children with developmental delays and typically developing children. The results of this study can be used as a reference for research on visual-perceptual games development for children with developmental delays and for research on digital games for children.

Keywords: Children with Developmental Delays, Visual Perception, Game Training, Usability