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Aesthetic Aspect of CAI Courseware to Developmental Disability Children Learning

Ki Sang SONG[a*1], Jung A LEE [b*2], and **Jae Kyung KIM[c*3]**
[a] *Department of Computer Education, Korea National University of Education, Korea*
[b] *Sung Kwang School, Korea*
[c] *Liberal Art Education (Englsih), Pai Chai University, Korea*
*[1]kssong@knue.ac.kr
*[2]adorer82@hanmail.net
*3 jkkim@pcu.ac.kr

Abstract: In this paper, aesthetic aspects of Computer-Assisted Instruction (CAI) courseware, especially the number of colors used in the software to the learning achievement of Development Disability Learners, are discussed. Randomly selected 50 students among 142 special needs students who attended the same school were divided into five groups of ten students, with each group using different courseware with different numbers of colors used. The results show that learners achieve better with courseware developed with more than 6 different colors than those of utilizing 2 or 4 colors. Interestingly, there are no significant differences between courseware(s) using more than 6 colors, and numbers of colors used in CAI courseware has keen relationships with learners' positive attitude and learning achievement.

Keywords: CAI courseware, Development Disability, Aesthetic aspect, Color

Introduction

The application of technology for special needs learners, assistive technology, prevails in many universities around world, with many of these approaches empower disabled learners to control environment, access technology, and overcome physical barriers. Moreover, providing educational resources such as CD-ROM titles or CAI courseware for learning enhancement have been tried through several institutions including Johns Hopkins University and Central Washington University [1].

Developmental disability indicates various handicaps in mental or physical functioning, and its common examples are autism, cerebral palsy, uncontrolled epilepsy, certain neuropathies, and mental retardation [2] with attention deficit hyperactivity disorder (ADHD). It is well known that children with ADHD often demonstrate significant educational [3] deficits. To enhance the potential for children dealing with ADHD, computers have been applied to the learning environment due to the possibility of individual learning with computers, and one of method to introducing computer to these learners is using well-designed Computer-Assisted Instruction (CAI) courseware.

Several aspects need to be considered for educationally effective CAI courseware and aesthetic aspects with color selection being one component. From the information processing theory of cognitive learning, a cognitive-based multimedia CAI courseware design method considers the number of colors and graphics as crucial points of the learner's cognition in order to foster attention [4].

Compared to normal learners, less research has been carried out regarding the development of disabled learners. Therefore, such technology as computers and the Internet were tested to determine the affect of adopted color numbers in courseware in relation to learners' achievement.

Little research has been done for the number of colors adapted to CAI courseware design; however, it is easy to agree that colorful courseware is more effective than a black and white version. However, if the colors are not effectively used to highlight teaching points, it is hard to expect desirable effects (such a statement is a prime spot for a citation). What may be extrapolated here is that color in courseware may contribute nicely and aid in visual impact, but more importantly be considered as readability using colors. Therefore, when developers create class aid material(s), color needs to be carefully selected to augment instructional impact.

Banaschewski, et. al. [5] reported that children with ADHD committed more errors on the Farnsworth–Munsell 100 Hue Test (FMT), particularly on discrimination of *colors* along the blue–yellow axis. As it is known that ADHD is associated with unexplained impairments on speed naming of colored stimuli, such observations imply that selecting colors and number of colors for CAI courseware for special needs learners are imperative.

Based on the Banaschewski's report this study was designed to ascertain the number of colors used for CAI courseware and their effect(s) to developmental disability learners, thus the focus on the number of colors was two, four, six, and eight colors.

1. Method

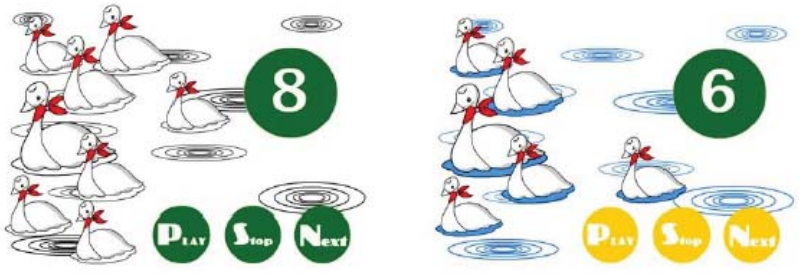
1.1 Subjects

Among 142 elementary school level mental retardation learners, 50 learners who were physically capable to operate a computer and with basic cognitive capabilities were randomly selected. The participated students for this experiment ranged from the second to sixth grade. Since the students' grades are different in each group, we have adjusted group participants to be almost age in average. The I.Q. range of each subject was 50 to 70.

1.2 Experimental Tasks

1.2.1 Courseware Design

The topic of the designed courseware consists of counting numbers from 1 to 10, and introducing counting the number of animals in each page as shown in the Figure 1.



(a) Two colors (b) Four colors

(c) Six colors (d) Eight colors

Figure1: Number of colors and drawings used in the courseware

The courseware utilizes buttons placed on the right side of each page containing learning objectives and three-step learning pages including a formative page. Additionally, buttons are placed on the bottom of each page, such as **Play**, **Stop**, and **Next**, to provide easier control of the courseware. Learning contents have 4 types: numbers with moving characters in the 1st stage, number narration with the same number of characters appearing in the 2nd stage, mouse dragging to check numbers after counting the Characters in the 3rd stage, and formative testing via typing numbers after counting characters in the last stage.

1.2.2 Conditions

The courseware has buttons placed on the right side of each page with learning objectives, and three step learning pages with a formative page. Buttons such as play, stop, and next placed on the bottom of each page provide easier control of the courseware. Learning contents have 4 types; Number with moving Characters in the 1st stage, Number narration with the same number of Characters appearances in the 2nd stage, Dragging mouse to check Number after counting the Characters in the 3rd stage, and formative test typing Numbers after counting Characters in the last stage.

1.2.3 Colors Applied in the Courseware

Ten colors from the Munsell color system, 5 basic colors (Red, Yellow, Green, Blue, and Purple) and 5 additional colors designed by adding basic color and neighboring complementary colors were used on 5 different test CAI courseware as shown in Table 1.

Table 1: Applied colors for five courseware

Courseware type	Applied Colors
Two colors	Red, Green
Four colors	Red, Yellow, Green, Blue
Six colors	Red, Yellow, Green, Blue, Purple, Yellow-Red
Eight colors	Red, Yellow, Green, Blue, Purple, Yellow-Red, Yellow-Green, Blue-Green
Ten colors	Red, Yellow, Green, Blue, Purple, Yellow-Red, Yellow-Green, Blue-Green, Purple-Blue, Red-Purple

1.3 Experimental Procedures

Pre-tests were carried out to check learners' differences in cognitive capabilities.' After there were no significant differences in the capabilities, 5 randomly selected groups were assigned different courseware using different color sets as depicted in Table 1.

Subsequently, the post-test and the achievement test were implemented after formal instruction. In addition, teachers who guided the learners' lessons were asked to give feedback regarding the students' learning aptitude tests in order to check learners' responses to the courseware.

2. Method

2.1 Pre-test and post-test

Table 2 shows the pre-test and post-test results of student group achievements.

Table 2: Pre- and post-test results of group average scores

Group	Test	Average score	S.D.	t	*p*
Group 1	Pre	48.50	25.28	0.95	0.926
	Post	49.00	30.53		
Group 2	Pre	49.50	26.81	0.000	1.000
	Post	49.50	24.20		
Group 3	Pre	49.00	27.86	2.631	0.027
	Post	64.50	31.74		
Group 4	Pre	48.00	31.90	4.375	0.001
	Post	65.00	32.48		
Group 5	Pre	48.00	31.55	2.283	0.048
	Post	64.50	43.03		

($p<0.05$)

Figure 2 depicts each group average score in pre- and post-test according to the number of colors used in each coureseware.

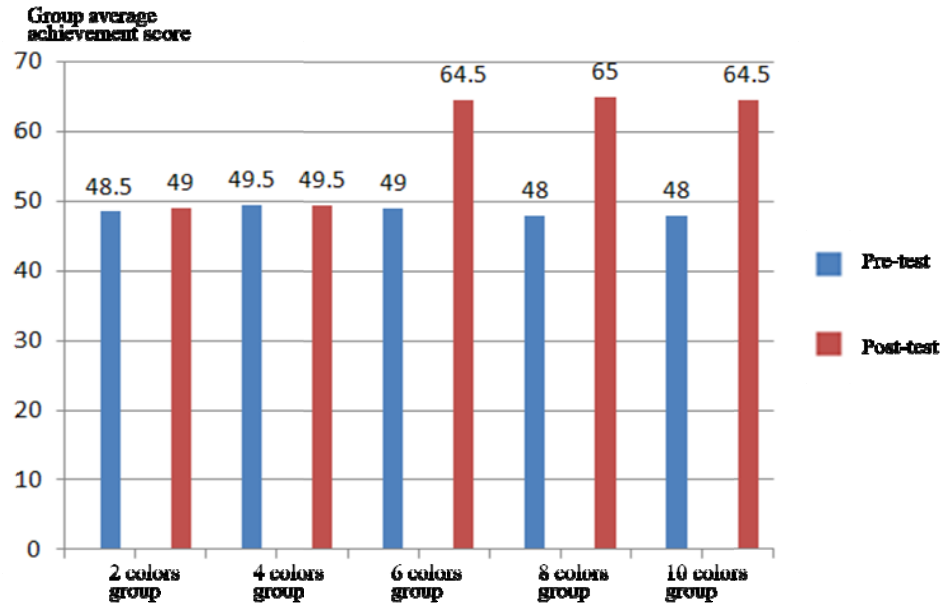


Figure 2: Group average scores in pre- and post-test

2.2 Teachers' report of students' aptitude of using CAI courseware

From the teachers' report of each group, classification ranging from positive attitude to negative attitude were created. Negative attitude marks indicate that teacher(s) reported students showing boredom or distraction while the students used the courseware. Teacher report results are depicted in Table 3. The teachers' subjective opinions were validated to clearly show the learners' attitude, however, some of the reports are excluded, and thus the sum percentile of positive and negative is not 100% in each group.

Table 3: Teachers' reports of students' attitude

Group	Positive Attitude (%)	Negative Attitude (%)
Group 1	9.9	16.6
Group 2	19.9	19.9
Group 3	36.6	6.6
Group 4	33.3	10.0
Group 5	43.3	6.6

3. Discussions

From Table 2 and Figure 2, comparing the pre-test and post-test results of student group achievements, it is clear that CAI courseware that use more than 6 colors are effective for mentally retarded learners in the second to sixth grades. However, there is no significant difference in achievement tests between courseware utilizing 6, 8, and 10 colors. Furthermore, we found that mentally retarded learners' better achievement is also related with positive attitudes toward CAI courseware, and it has been observed by the teachers as shown in Table 3. From Table 2 and Table 3, it is found that CAI courseware needs to implement at least 6 colors and that less than 4 colors using courseware is not beneficial for mentally retarded learners.

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