Effects of ordinary and adaptive toys on pre-school children with developmental disabilities

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Abstract

Toys help children in mastering developmental tasks. This study investigated toy effect on children with developmental disabilities as they engage in using ordinary and adaptive toys. A single-subject design was used to identify the effects on their toy play abilities. Differences in toy effects between playing ordinary and adaptive toys were examined. Three special education teachers chose ordinary toys and modified ordinary toys. Modified ordinary toys, i.e., adaptive toys, were designed according to the individual disabilities of participating children, treatment goals, and the toy types. Three children with developmental disabilities from pre-schools in Taiwan were enrolled. Appropriate participation of three pre-schoolers increased dramatically in playing adaptive toys during intervention phase. The toy effects demonstrate that when using adaptive toys, children with developmental disabilities may respond better during toy play sessions. © 2007 Elsevier Ltd. All rights reserved.

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1. Introduction and literature review

1.1. Toy function for children with developmental disabilities

As facilitators of play, the special education teacher must consider a variety of factors, including the unique capabilities of the child, the adaptation of toys and materials, and the impact of the environment and setting. Many toy companies in Taiwan donate toys to early intervention centers to get tax relief. Therefore, teachers in early intervention setting have more opportunities to apply toys in their teaching. Children with developmental...
disabilities are known to have limitations in their movement, and frequently have limitations in toy play behaviors (Pierce-Jordan & Lifter, 2005; Rutherford & Rogers, 2003). As is widely recognized, young children with developmental disabilities often engage in less play activities than their peers without disabilities, and frequently require special intervention to enhance play behaviors, such as a touch-free switch (Reid, DiCarlo, Schepis, Hawkins, & Stricklin, 2003). For children with developmental disabilities, toy play offers useful experience and assists in the development of sensory-perceptual, motor, social, psychological and intellectual functions (Lewis, Boucher, Lupton, & Watson, 2000; Malone, 1999).

1.2. Adaptive toys used in early intervention settings

In early intervention settings of Taiwan, special education teachers started to create adaptive toys by modifying ordinary toys, or changing the sequence of playing with the toys for children with disabilities. To meet the needs of children with developmental disabilities, special education teachers got free courses on how to modify toys. Adaptive toys typically have adaptive mechanisms, such as Velcro strips to help a child hold the toy, and switches that assist in toy operation (Klauber, 1996). Schemes used to identify target toys include selecting potentially interesting toys, adapting toys and then observing how children with disabilities respond to the toys (Kok, Kong, & Bernard-Opitz, 2002). Their research results demonstrated that children with developmental disabilities who are deprived of normal play opportunities are viewed as having a second disability. Additionally, relative to children without disabilities, children with disabilities are more likely to engage in play requiring lower levels of cognition (i.e., functional play) than play requiring higher levels of cognition (i.e., constructive and dramatic play; Langone & Malone, 1998).

1.3. Responses of children with disabilities toward different types of toys

Most studies have grouped toys into different types, based principally on function, type of activities, and age appropriateness (Marino, 1991; Todd & Reid, 2006). Different toy types include art and craft materials, dolls, construction toys, grasping toys, manipulative toys, mirrors, mobiles, push pull, puzzles, ride-on toys, and transportation toys (Goldbart & Mukherjee, 2000; O’Gorman Hughes & Carter, 2002). Pre-school and primary school children typically enjoy playing with educational toys, such as electronics devices, computers, and science toys, in addition to arts and crafts (Cantu, 2004). Parsons and Howe (2006) examined the influence of realistic character toys derived specifically from television or film superheroes on the level of physical activities of 12 children. Their result showed superhero play (the active physical play of children pretending to be media characters) did not make children physically active.

A literature review of work addressing toys and the performance of children in different context indicates that toys affect child performance. How to make child active involvement would be the aim of this study. Therefore, training effects on the toy play behaviors of children when playing with ordinary and adaptive toys were investigated. Ordinary toys are typically play materials that parents and children can purchase from toyshops; whereas adaptive toys are play materials that have been modified for different needs or treatment goals of children with developmental disabilities. This study investigated how children with disabilities response to ordinary and adaptive toys.
2. Method

2.1. Participants

A 3-year 6-month-old Taiwanese boy (subject 1), a 4-year 1-month-old Taiwanese girl (subject 2) and a 4-year 9-month-old boy (subject 3) participated in this study. Three children were diagnosed as having developmental disabilities. They all had moderate to severe physical disabilities and mild intellectual disability. The target participants attended a public pre-school in Taipei and were able to follow the rules of simple games. Table 1 described the background information of three participants. The researcher who is a licensed occupational therapist, helped teachers to modify ordinary toys chosen by three special education teachers who had at least 3 years of teaching experience.

3. Instrumentation

3.1. Toy play materials

Modified ordinary toys, i.e., adaptive toys, were designed according to the individual disabilities of participating children, treatment goals, and the toy types. Rules of modifying toys were adapted from literature about adaptive toys and development of children (Klauber, 1996; O’Gorman Hughes & Carter, 2002). Of priority concern is to consider the features of toys that appeal to children, how the toy is used and the toy’s physical construction. Therefore, a toy analysis checklist was used and is listed in Table 2. The example of adaptive toys used in this study was listed below.

1. Non-slip materials were used to prevent a toy from moving out of reach.
2. Velcro strips were placed on toys to promote stability.
3. Suction cups and rubber pads were used to prevent toys from falling.
5. The battery interrupter was applied to attach a switch to any battery-operated toy.
6. Cylindrical foam padding in a variety of colors and widths was used as a “quick-fix” for making crayons, markers and musical instruments easier to use.
7. Large knobs were utilized in puzzle adaptation and piano keys.

4. Procedure

A single-subject research design was chosen to investigate the effects of adaptive toys on the toy play behaviors of the three participants. A multiple baseline design was implemented with three phases. During three phases, a toy was placed in front of the participant. The teacher sat across a table from the participant. No verbal cue was given, and errors were not corrected. The participant was given five opportunities to handle the toys correctly, such as to make the toy...
move, or to make several sounds. Five toys were used per time for each participant: (a) a baseline phase during that children used ordinary toys; (b) an intervention phase during that children used adaptive toys; (c) a maintenance phase during that children used toys got ride of adaptation. Observations were made from a classroom designed for free play sessions at a pre-school. The procedure about what toys the target participants played with was selected by three special education teachers according to their instructional design and treatment of each participant. Five different toys that required correct response were used in each 30-min free play session, and about 150 toys (include 70 modified toys) were used. Prior to the commencement of the intervention, the teachers at the pre-school were given an explanation of the design and a timetable of the toys that were used on each particular treatment session. The children were timetabled to have a 10-min of instruction by the special education teachers before being videoed. Videoing started approximately 20 min for each session. Three children were observed during 20-min toy play sessions and twice a week.

5. Measurement procedures

5.1. Dependent variables

The behaviors of appropriate participation selected for intervention were monitored for three participants. Definitions of appropriate participation was based on these provided by Robertson,
Green, Alper, Schloss, and Kohler (2003). Appropriate participation was defined as when participants used the tools in the right way, or when a participant responded correctly to game play. Appropriate participation meant socially acceptable toy manipulation and remaining within a designated area until the task was completed.

5.2. Rating of appropriate participation in this study

- 1 = right action: students handle the toy in a right way at least three times (i.e., touch the operation button).
- 2 = functional action: students manipulate the toy in a right way and make the toy functioning at least three times (i.e., make the car moving; create the musical sound):

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\text{percentage of correct responses} = \frac{\text{score of playing 5 toys}}{2 \times 5 \text{ toys}}
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5.3. Observations

Observations were recorded using a Panasonic model NV-GS65 camera to videotape the toy play sessions. These children were observed for 20 min twice a week over an 11-week period. Observers were trained to a 90% accuracy criterion on target behavior before the study began. Consequently all data were calculated as a percentage of appropriate participation.

5.4. Inter-observer reliability

The primary observer was the research assistant and the secondary observer was a teaching assistant in the pre-school. The primary observer initially trained the secondary observer using 6×20 min videotapes of children playing. These tapes were not used for calculation of inter-observer reliability. During inter-observer reliability observations, both observers independently observed and recorded the child’s behavior from the videotapes. Overall point-by-point reliability was calculated as was reliability for occurrences and non-occurrences of appropriate participation in target toys. Inter-observer reliability was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. An agreement was when both observers simultaneously coded the same behavior in the same session. A disagreement occurred when both observers coded different behavior in the same session.

6. Results

6.1. Inter-observer reliability

Mean point-by-point reliability of appropriate participation was 90.2% (range 86–95) for subject 1, 89% (82–94) for subject 2, and 87.8% (81–92) for subject 3.

6.2. Data analysis

The results of the adaptive toy interventions across three subjects are shown in Fig. 1. The phase lines distinguish the baseline phase with ordinary toys, then the intervention with the
adaptive toys, and then the maintenance with the toys got ride of adaptation. During baseline, subject 1 displayed 11% (range 10–15) of appropriate participation while playing ordinary toys, subject 2 displayed 16% (10–30) of appropriate participation, and subject 3 displayed 19% (10–25) of appropriate participation.

The percentage of correct responses while playing adaptive toys with the teacher’s instruction during intervention phase, subject 1 exhibited 54% (range 30–70), subject 2 exhibited 61% (30–80), and subject 3 exhibited 68% (45–85). During maintenance phase, subject 1 presented 33% (range 30–50) of appropriate participation while playing adaptive toys without the teacher’s instruction, subject 2 presented 43% (35–45) of appropriate participation, and subject 3 presented
43% (35–50) of appropriate participation. Once again, three pre-schoolers showed immediate and dramatic increases in playing adaptive toys during intervention and same gains were maintained during maintenance.

7. Discussion

This preliminary study documents toy play behaviors of developmental disabilities during play with ordinary and adaptive toys. This study identified the effect of adaptive toys on children with moderate to severe physical disabilities and with mild intellectual disabilities. In the intervention phase, all participants showed higher scores in correct responses. Therefore, all three participants demonstrated higher effective play behaviors in modified toys such as electronic toys with a switch and blocks with Velcro strips than toys without adaptation.

There was a marked difference on the dependent variables for the three children. Adaptive toys contributed more correct responses due to simplify the method or access of manipulating the toy. Modified electronic toys also provide the feedback and reinforcement system to player to enhance their motivation and movement adjustment. In this study, adapted electronic toys, such as a touch-free switch, showed higher percentage of correct responses than block modified with Velcro strips and puzzle with large knobs.

This research result was also similar with another study that compared the effects of different toys types, demonstrated that free blocks generated the highest levels of creative play. Then electronic toys and model blocks yielded the lowest levels of creative play. Electronic toys were associated with lower levels of cognitive play than puzzles and free blocks (Kim et al., 2003; Langone & Malone, 1998). In general, children with mild intelligent disabilities and severe physical disabilities played much better with modified toys. Modifying toys requiring fine motor skills and low cognitive levels of play requires fewer physical demands and hand function. These kinds of modify toys, such as electronic toys with switches and musical toy with suction cups, provide a context for an individual to observe, express, and experience movement (Cole & Swinth, 2004; Trevlas, Matsouka, & Zachopoulou, 2003).

Children with developmental disabilities response variably toward different types of toys. They showed more social behavior in social toys which identified by most studies include balls, dress-up clothes, housekeeping toys, blocks, puppets, and toy cars or trucks. They also demonstrate more creative play in puzzles, Play-Doh, books, and art materials (Ivory & McCollum, 1999). Some researchers have manipulated toys promoting different social or cognitive levels of play to examine their effects on social behaviors of children with disabilities (Pierce-Jordan & Lifter, 2005; Villarruel, 1990). This study also discovered social interaction and cognitive levels of play for children with disabilities vary with toy types that were same as their experimental results.

Emotionally disturbed children performed the best in a distraction-free environment while engaging in a structured activity (Kok et al., 2002). Students with low language were observed to have shorter durations of engagement and less interaction with their teachers (Qi, Kaiser, & Milan, 2006). Future study may try to use a distraction-free environment to rule out environmental effects and obtain only the effect of teacher–child interaction during toy play. Moreover, the literature suggests that having a sense of self within the environment is affected by freedom to choose or select toys; thus, making choices allows children to develop a sense of competency (Torrey, 1987). Further research appears warranted then to refine components of adaptive toys in order to find or to modify appropriate toys for children with disabilities.
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References