Assistive Technology: Using Switch-Activated Toys and Devices For Preschool Children with Motor Impairments
An Instructional Module for Special Educators and School Support Staff

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Abstract: Many special education teachers have not received adequate training to make informed decisions when implementing assistive technology tools to enhance the learning of their special needs students. Yet, schools are mandated to provide special education students appropriate assistive technology interventions to support their learning needs. For this study, a web-based instructional module on using switch-activated toys and devices for preschool children with motor impairments was developed to provide special educators a free on-demand informational resource. The author tested the instructional module to study its effectiveness on empowering special educators to incorporate switch-activated toys and devices. The results and implications of this research should help to refine this module and lead to the development of future free on-demand modules for special educators in other areas of disabilities.

Introduction

Young children learn a multitude of skills through play opportunities and interactions. However, students with severe motor impairments are unable to actively participate and play with toys and others without additional supports. The incorporation of assistive technology (AT) tools gives children with motor impairments access to enjoy the activities and opportunities in their environment with their peers and others. However, research shows that although schools are mandated to provide appropriate AT, many special educators in the pubic schools have not had training in the decision making process to incorporate AT that can enhance student learning (Bausch & Hasselbring, 2004; Judge, 2006). Marino, Marino, and Shaw (2006, p. 23) state that this creates a situation which "leaves special educators in a position where they must make decisions in relative isolation."

Special educators need to become knowledgeable about the process and selection of appropriate AT devices for special needs preschoolers with motor impairments. In addition, special educators will also need to become knowledgeable about, and gain self-confidence in implementing AT strategies and tools, so that they are able to confidently deliver instructional strategies that affect student learning. According to Moore and Wilcox (2006), training and support influences confidence, and confidence

can affect the level of ability in delivering instructional strategies that affect student learning. There is a need to support and empower special educators in the AT decision making process. Successful integration of AT requires appropriate training, ongoing support, and practice (Judge, 2006). As such, teachers are still responsible for student learning and must continuously challenge students in different ways. When a decision for utilizing an appropriate AT device is made and found to be compatible, it may enable children with the most severe disabilities to participate in activities (Campbell, Milbourne, Dugan, & Wilcox, 2006). Hamm (2006) agrees that AT may be the only means by which children with significant disabilities can engage in physically and also enable children to communicate and gain mobility.

In this study, a Web-based instructional module for special educators who work with preschool children with motor impairments was developed. This module focuses on using switch-activated toys and devices to help encourage these young children to participate actively in play activities and opportunities. Concepts presented in the module are to provide special educators an understanding of using single switch-activated toys and devices that are also developmentally appropriate for their young learners. The module cites several studies and infuses some personal experiences shared by this researcher.

Review of Literature
Young children learn best through a variety of play activities; and play has been described by Jansma as "the 'work' of children" (as cited in Murata & Maeda, 2002, p. 237). The play environment can be arranged and organized to provide meaningful opportunities for preschoolers to interact with their peers and other adults. Learning opportunities can be incorporated into children's daily play activities. Children learn social skills through sharing, taking turns, make-believe, and cooperative play. Pre-academic skills can also occur while children identify colors, look at picture books, find their names, and count toys. Painting, drawing, coloring, and scribbling encourage children to increase fine motor and prewriting skills. Organization skills can be taught while children sort toys, clean up work/play areas, and put away their belongings. Language and behavior skills are intertwined throughout all the interactions and activities as teachers and other adults speak and listen to the children and promote positive behavior interventions. According to Besio (2002), play is the most important activity and is the best way for children to learn developmentally appropriate skills.

Crucial windows of learning opportunities that allow optimal language, motor, and social skills to develop are open during the children's preschool years. Studies suggest that early intervention AT implementation for young students with and without disabilities can enhance their abilities to interact and control their environment (Wielke & Hadadian, 2003). Toddlers and preschool children demonstrated increased enjoyment, communication, and social participation when play activities became accessible to them. This accessibility enabled children to become successful in playing with cause and effect toys, thus causing them to repeat those actions for continued enjoyment. Eventually, their ability to control their environment through the use of AT motivated them to generalize their skills in other situations.

Besio (2004) agrees that preschool children learn a range of important skills through play and acknowledges that the importance of play has an effect on the development of cognitive, motor, language, and social skills. He also goes one step further and explains that as children grow and become acclimated to using AT in their play, more complex activities may be posed to challenge their abilities. By keeping preschool children interested and engaged in learning and playing, he states that teachers need to be prepared to have an ample selection of interesting items with which children can interact. He suggests a toolkit containing a variety of switches, toys, and devices would be beneficial to have on hand to modify the AT intervention as necessary. Challenging the children by creatively "exploiting" the usage of the same items in the toolkit collection can also offer a new unexpected effect or new type of play activity (Ashton & Johnston, 2003).

Children with motor impairments or significant physical disabilities often have little or no control over their voluntary muscle movements in their limbs. This makes it extremely difficult for preschool children to participate in play activities alone or with peers. Developing educational plans to include strategies to overcome these barriers that interfere with play opportunities can be challenging for special educators. The success of teaching children with motor impairments to control their environment at this young age can enhance or limit their capabilities of maximizing their future independence (Besio, 2002). Thus, implementing AT strategies in different environments is necessary to maximize participation, social interaction, communication, and mobility (Lane & Mistrett, 1996).

Assisting preschool children with special needs by utilizing toys with AT switches, devices, and tools can motivate play interactions. Glennan and Decoste (as cited by Ashton & Johnston, 2003) add that a child may be encouraged and motivated to replicate a movement of his or her body part by using switch activities. By adapting small battery-operated toys, children with disabilities are able to enjoy playing while they learn the concept of cause and effect. A variety of cause and effect toys, adapted toys, and devices can enable young children with motor impairments to respond by activating and reactivating them again and again. Having these prepared ahead of time and available to offer more play opportunities and options makes learning more effective and enjoyable. Learning the concept of cause and effect is often the child's "first step" towards gaining independence which may enhance his or her ability to participate, interact, communicate, and obtain mobility in different environments.

Methods
The design of this Web-based instructional module was created using the Web authoring tool, Dreamweaver. The Internet accessibility allowed the test population of special educators and other school support staff to access the module and information at their own convenience without incurring any cost. The instructional module was available to the test population on-demand and enabled them to retrieve the information at any time and as often as they found it necessary even after completing the module.

Survey Monkey (http://www.surveymonkey.com/), an online survey Web site was utilized to create the demographic and attitudinal surveys, as well as the pre- and post-tests. The Web site also collected and provided the data to this researcher for analysis.

Digital photos from this researcher's personal library and from other Web sites were imported for visual supports and to accommodate different learning styles. Embedded tests within each section were created using Java Script within the Dreamweaver software. The researcher's personal reflections were also integrated in each section to establish a deeper understanding of the respective concepts. In addition, several Web site links to related Do-It-Yourself projects were also provided.

Eight Web pages were created within this instructional module. The first page was the Welcome page which gave a brief introduction of the Web site. The other seven pages were focused on different skills and objectives. The terminal objective of this module was: Given a Web-based instructional module, the learner will increase an understanding of the benefits of using switch-activated toys and devices for preschool children with motor impairments. The seven sections and their objectives were:

1. Learn & Play: Given four choices, the learner will correctly identify the importance of play for preschool children.
2. Cause & Effect: Given four choices, the learner will correctly identify the concept of cause and effect.
3. Switches: Given four choices, the learner will correctly identify the function of a switch.
4. Toys & Devices: Given four choices, the learner will correctly differentiate between a toy and a device.
5. Switch-Activation: Given four choices, the learner will correctly identify the purpose of switch-activation.
6. Positioning: Given four choices, the learner will correctly identify positioning as referred to in this module.
7. AT Preschool: Given four choices, the learner will correctly identify outcomes of incorporating AT strategies in the preschool classroom.

The participants of this study were asked to test the instructional module developed by the author. Participants of this study were contacted in person, by email, or by phone. The Web site's URL address (http://www2.hawaii.edu/~jhomori/SAT&D_index.html) was emailed to them for testing at their convenience. Upon completion of the Web based module, the participants were asked to contact the researcher by email or phone. Personal information gathered from the Demographic Survey revealed that the participants' ages ranged between 18-59, included both genders, shared educational degrees from high school to Masters, and varied experiences in working with children who have motor impairments.

Results

Data were gathered utilizing Survey Monkey's free Web tool, which indicated that there were 27 respondents who completed the Demographic Survey. The Demographic Survey was presented as the first survey on the module's home page for participants to

complete before proceeding to the content portion of the module. Immediately following the Demographic Survey, participants were asked to complete a Pre-test for baseline data; however, there were only 21 respondents who completed this test. After the completion of the module, only 17 participants completed the Post-test, and 16 completed the Attitudinal Survey. Due to the inconsistent number of respondents who completed the surveys, the IP addresses along with dates and times were identified and aligned using Survey Monkey's reporting tool in order to eliminate those participants who did not complete both pre- and post-tests. After this elimination process, there were 17 respondents whose surveys were analyzed, however, there was one respondent who did not complete the Attitudinal Survey but the pre- and post-test data were included in the analysis.
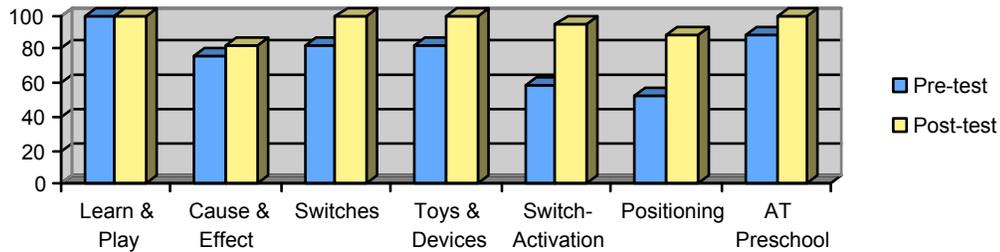

Figure 1. Comparative data between pre- and post-tests

Comparative data between the pre- and post-tests of each of the module's sections are shown in Figure 1. The data shows the percentages of correct answers in each of the seven sections based on the 17 respondents who complete the pre- and post tests. Increases in understanding the content in six sections are noticeable, and a large increase in the Switch-Activation as well as the Positioning sections are identified. All of the participants answered the question in the Learn & Play section correctly in both of the pre- and post-tests.

The final portion for testing this module concluded with an Attitudinal Survey. Eighteen participants completed the survey, however, two respondents were eliminated as a concurrence of the elimination process; thus, the results of the 16 respondents are revealed in Table 1. No one selected Strongly Disagree as a response.

In addition to the 12 Likert-scale questions, there were also 3 open-ended questions. Six respondents replied to the open-ended questions addressing the design of the module. Two respondents commented "well done," while one stated, "The site looked too simple and there was not enough visuals." Two other respondents suggested creating a link from the surveys back to the Web site, as Survey Monkey requires the user to use their browser's back button several times to return to the module. Another participant commented that the "site was very helpful as a refresher and to give a bit more info to my overview from several years back. Thanks so much. The format and pictures were excellent and the reflections helped bring it home."

Only two participants answered the question which considered the possibility of utilizing a Web-based instructional module for other areas of AT. Both suggested the area of communication.

Table 1. Attitudinal survey results

Attitudinal Survey	Strongly Agree	Agree	Disagree
The instructions and expectations of the instructional module were clear.	69%	31%	
The instructional module was user-friendly and easy to navigate.	81%	13%	6%
The instructional module was motivating and held my attention until its completion.	56%	38%	6%
The content presented in each section were clear and easy to grasp.	69%	31%	
There were sufficient amount of examples and non-examples in each section.	50%	50%	
The photos and graphics were helpful in understanding the content.	44%	44%	12%
The researcher's experiences and reflections were helpful in providing a deeper understanding of the content.	56%	38%	6%
I have a better understanding of the importance of learning cause and effect.	63%	25%	12%
I have a better understanding of the importance of positioning.	62%	19%	19%
I have a better understanding of using switch-activated toys and/or devices.	69%	31%	
I have a better understanding of the benefits of using assistive technology with preschool-aged children with motor impairments.	69%	19%	12%
I feel confident about using switch-adapted toys and devices with my students.	50%	44%	6%

There were four comments made in the "Any other comments" section, of which one just noted "None." Other comments included:

- Thank you! This was very helpful and it didn't require too much time to complete. It was clear and concise.
- There were some spelling errors in the surveys that were distracting for me to comprehend the questions. Overall, this module is very informative and helpful for teachers to learn about AT switch-adapted toys and devices for preschool children with motor impairments. Keep up the good work! :)
- This was a great introductory unit. The only problem I had was that I was already familiar with the concepts, so was not able to rate you high for "better understanding" as worded in the survey.

Discussion and Conclusion

In comparing the pre- and post-test data, it appears that all participants gained knowledge in six of the seven content sections. The pre- and post-test data collected from the Learn & Play section suggest that the participants already understood the content in this section, or that the test question was too simple, or the answer to the question was too obvious since all respondents scored 100% in both tests. It is interpreted by this researcher that the pre- and post-tests results of the Learn and Play

section are due to a combination of these suggestions. Perhaps the author overlooked or underestimated the participants' knowledge when developing this section. Since the audience for this instructional module is targeted towards educators who work with young children, it should be understood that they already have this knowledge; and therefore, revisions to address this section might be considered.

The Attitudinal Survey revealed that 100% of the respondents agreed that:
- the instructions and expectations of the module were clear;
- the content presented in each section were clear and easy to grasp;
- there were sufficient examples and non-examples in each section; and
- they have a better understanding of using switch-activated toys and devices.

In addition, 94% of the respondents agreed that:
- the module was user-friendly and easy to navigate;
- the module was motivating and held their attention until its completion;
- the researcher's experiences and reflections were helpful in providing a deeper understanding the content; and
- they felt confident about using switch-adapted toys and devices.

Also, there were 12-18% of the respondents who disagreed that:
- the photos and graphics were helpful in understanding the content;
- they have a better understanding of the importance of learning cause and effect;
- they have a better understanding of positioning; and
- they have a better understanding of the benefits of using assistive technology with preschool children with motor impairments.

These points will be focused upon as the module is revised to improve its effectiveness. The sections on Cause and Effect, Positioning, and AT Preschool sections are areas that appear to need the most clarification. In addition as reflected by the respondents' comments, the photos and graphics will also need to be improved and/or increased in number to represent more relevant visuals to support each content section.

Although 18% of the respondents felt they did not have a better understanding of positioning, the data collected from the pre- and post-tests indicate a 35% increase in scoring correctly within this section. This may be a reflection of the respondents' confidence levels and a possible degree of uncertainty regarding the physical abilities and limits of each student, in which positioning must be taken into careful consideration when working with children with motor impairments.

A limitation of this study that needs to be taken into consideration is the small sample size of 17 special education teachers and educational aides. The study also focused on a specific disability within a certain age-group of children. The survey indicated that 47% of the respondents work, or have worked with preschool children with motor impairments, and 33% have indicated they have not received any AT training. The implications drawn from this study may not be an accurate reflection of the general

population of educators, especially for those who work with students who have other disabilities or multiple disabilities.

The purpose of this study was two-fold. The first was to test the effectiveness this instructional module. The data collected revealed that although most participants met each section's objectives, there were a few who did not feel they gained additional information. This may be a reflection of one of the respondent's comments regarding the wording of "better understanding" in the Attitudinal Survey as it may be due to knowledge that was already understood. However, it is important to consider that the information presented in this module was to provide special educators a basic introduction into this topic.

It was also the goal of this researcher to provide special educators instructional information and strategies which would allow the them to gain confidence in making AT decisions, and about using switch-adapted toys and devices with their preschool students. After completing the module, all of the respondents who participated in the study indicated that they have gained a better understanding of using switch-activated toys and devices. In addition, 94% of the respondents indicated they felt confident about using switch-adapted toys and devices with their students. This infers that the instructional module was successful in delivering training in this method.

As a result of this study, it appears that the design of this instructional module was effective and most participants gained information from its use. The format of this Web-based instructional training provided beneficial information to special educators who have not received AT training and who otherwise may not have been able to access the training without having to pay for it. Informal conversations with some of the participants revealed that educators appear to be open to accessing the information they seek at their own time, place, and pace. The fact that the instruction can be accessed at no-cost in the privacy of their own homes and at their own convenience is the most appealing method of receiving training for busy teachers who also carry the role of family providers.

The creation of additional cost-free Web-based modules that focuses on other disability areas may prove just as helpful, not only in providing instructional strategies to educators, but also in providing instructional information and decision making knowledge in a timely manner. It is important to provide special educators timely AT training and support, as it can instill self-confidence and affect their level of ability when implementing these instructional strategies, as timing can be crucial in having a direct effect on student learning. Since special educators are held responsible for student learning, this is one method that can help to provide timely training and support for implementing specific AT strategies. Specific training and supports may not be available at a time when there is an immediate need for it. Thus, the on-demand availability of a Web-based instructional module can provide sufficient information and instill self-confidence for educators to deliver specific AT instructional strategies that impact student learning.

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