Use of Visual Auditory Simulation Technique in Promoting On-Task Behavior of Children

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Abstract

All learners need to pay attention on what they are learning; and paying attention involves the sensory register of the learners. Many researchers have found that the inability for learners to perform well can be attributed to the inability of them in paying attention while performing tasks. Young children with inattention problems will find difficulty in concentrating on a task, do not finish what they start, do not listen and always lose things. Children with special needs, especially those with Attention Deficit Disorders (ADD) or Attention Deficit Hyperactivity Disorder (ADHD) are especially prone to lack of attention span and thus they are found to be off-task at most of the time during the process of learning. Other groups of learners who used to show lack of attention are such as children with autism, Down's syndrome, dyslexia and slow learners. It is therefore particularly important for learners to be on-task whenever learning tasks are performed.

The objectives of this research is to develop a courseware using visual auditory simulation technique (VASTech) that incorporates multimedia flash to systematically foster the attention for mainstream (3 – 6 years chronological) and special children (7 – 12 years chronological). Using VASTech, this system blends the multiple intelligences theory with the multisensory approach in instructional design to form a holistic system to build the attention of young children.

The software consists of three modules, i.e. beginner, intermediate and advance. There are five games/tasks in each module which requires engagement from the child in order to fully perform the games/tasks. Each game differs from one to another in terms of the time frame needed to complete the game and its nature of complexity. The duration for each game is set in an incremental basis, which means in Module 1, game 1 will last for 1 minute, game 2 will last for 2 minutes, game 3 will last for 3 minutes, game 4 will last for 4 minutes and game 5 will last for 5 minutes. Each subsequent game will advance 1 minute from the previous game. The purpose of setting the short timeframe in an incremental basis is to allow gradual, systematic and long lasting training of enhancing learners' attention while performing the activities.

This research adopts the non-equivalent control group design (for mainstream children) and pretest-posttest control group design (for children with special needs) by using VASTech in promoting the on-task behavior of 55 (20 experimental; 35 control) mainstream and 54 (24 experimental; 30 control) special children. The pre-schools and special needs centers involved were located in Klang Valley, Malaysia. The pre- and post- tests were each administered before and after the intervention. They were adapted from one of the Fuerstein's Instrumental Enrichment Assessment and comprise tasks designed based on the cognitive function relating to attention ability and the applications underlying the task at hand to engage the children within timeframes. This was aimed to seek to channel the dynamism of the children on the task that the child was required to perform, to investigate how far the on-task behavior of the children were being promoted. "On-task behavior" is shown when a child is engaged in or working on a specific task or activity focusing on pre-academic skills. The frequency of on-task behavior before and after the intervention was recorded. The difference in the score of the task given before and after the intervention will determine the effectiveness of the courseware.

The Paired samples t-test results show significant improvement of on-task behavior for special ($t=-3.69$, $p<.05$) and mainstream children ($t=-8.97$, $p<.05$) in the experimental groups but not in the control groups. To be effective as learners, students must develop the ability to maintain focus on incoming information over a sufficient period of time for effective cognitive processing to take place and also to withhold responses to incidental or non-relevant stimuli. Individuals should have

developed the ability to maintain attention to a task for at least fifteen minutes to be effective at many schools and work activities. By using VASTech, coupling with the systematic incremental approach in promoting children's on-task ability, this study produces an educational and instructional intervention tool for educators and parents which can facilitate the fostering of children's attention.

Keywords: Visual auditory simulation technique, on-task behavior, children with special needs, young children, attention, game/task-based activity

Introduction

Learning requires all learners to pay attention to what they are learning. Many researchers have found that the inability for learners to perform well can be attributed to the inability of them in paying attention while performing tasks. Children at the early childhood years are easily prone to hyperactivity and poor attention. Young children with inattention problems will find difficulty in concentrating on a task, do not finish what they start, do not listen and always lose things (Lerner, 2003). Children with special needs, especially those with Attention Deficit Disorders (ADD) or Attention Deficit Hyperactivity Disorder (ADHD) are especially prone to lack of attention span and thus they are found to be off-task at most of the time during the process of learning.

Other groups of learners who used to show lack of attention are such as children with autism, Down's syndrome, dyslexia and slow learners. Currently, children with attention deficit hyperactivity disorder and some mainstream children who are active are prescribed with drugs like Ritalin and Dexadrine (Lerner, 2003). There is no doubt that these drugs can help in the reductions in restlessness, crying, distractibility, excitability, frustration and other hyperactive symptoms of the child, and have given positive measures on behavioral control, these drugs that are mentioned earlier are accompanied by negative side effects such as insomnia and decreased appetite, and optimum dosage is difficult to be determined (DuPaul, Barkley & McMurray, 1991). It is obviously shown that the negative impact on the learners bring forth qualms to parents and educators. Furthermore, to be dependent on stimulant medication is not effectively helping the child to function in the society. It has been reported that children who face with learning difficulties, dyslexia and slow learners are among the children who exhibit behavior of hyperactivity, inattention and impulsivity (Lerner, 2003). The problem has been constantly a hindrance to the children's learning.

The Importance of Being Able to Stay On-Task

Children's ability to be able to stay on-task is very important in today's classroom. It is this ability that allows them to function effectively within society. It is therefore particularly important for learners to be on-task whenever learning tasks are performed (Ormrod, 2003).

Amato-Zech, Hoff, and Doepke (2006) adopted the self-monitoring strategies among students with special needs in a classroom where these children have to wear an electronic beeper that vibrates to provide a tactile cue to self-monitor. The result has indicated an increase in on-task behavior among children with special needs from a mean of 55% to more than 90% of the intervals observed.

Apart from the study mentioned, past researches have been using a variety of methodology to measure on-task behavior in a variety of dependent variables, including frequency or number of performance-per-minute in order to meet the mastery criteria (speed and accuracy for behavioral fluency) of a defined tasks and the engaged time to perform the tasks to derive a more comprehensive conclusion of the effectiveness of an intervention done on the specific children.

Past Research on Attention Training

Paying attention involves the sensory register of the learners (Ormrod, 2006). Since paying attention involves mental process, by planning a systematic approach for effective learning task, monitoring comprehension, evaluating the process towards the complement of a task and maintaining motivation to see a task to completion may hold a substantial support to increase the learners' attention span.

Conscious control of attention helps children to understand that the level of attention required for a task varies with the task and that they can adjust the focus of their attention accordingly. This sense of personal control is related to the efficient performance of tasks and thus paying attention while on-task. The level of thinking that involves active control over the process of thinking that is used in learning situations is important to foster children's attention ability.

Williams (1989) utilized adult-based attention training materials with a group of six ADHD children. The forty hour attention training (ATT) has yielded significant improvements in pre-post measures of attention. Another study by Klingberg, Forssberg, and Westerberg (2002) who had developed a version of ATT with a central focus on non-verbal working memory skills, has found that the experimental group produced significantly greater gains on cognitive measures of sustained and executive attention reflecting performance on visual-spatial working memory.

Posner, Rothbart, Vizueta, Levy, Thomas and Clarkin (2002) tested the idea that implementing ATT early in development may actually enhance attention and executive control networks. Although the effect of ATT has not yet been understood through neurological basis, functional Magnetic Resonance Imaging (fMRI) evidence suggests that ATT is impacting brain function (Mateer & Mapou, 1996; Olesen, Westerberg, & Klingberg, 2004). Further evidence also suggests that computerized game-like tasks can be utilized to assess and/or train attention functions in pre-school-aged children (Berger, Jones, Rothbart, & Posner, 2000). As a result, there are many other researchers who have also adapted ATT materials to be developmentally appropriate for both typically developing and special need preschoolers.

In a nutshell, these studies provide significant support for the hypothesis that adaptive training of executive function skills and sustained attention skills may positively impact the attention skills development of elementary school aged children with ADHD.

Promoting On-Task Behavior through Visual Auditory Simulation Technique

Micheletti (1999) studied the treatment for children with attention hyperactivity disorder (ADHD) by having four groups of children, whereby each group was either using stimulant medication, auditory and visual stimulation (AVS), auditory and visual stimulation (AVS) plus medication as well as the self-selected comparison group. The study found that both the AVS and AVS/Stimulant medication group indicated significant statistical cognitive and behavioral changes at $p < .05$, $p < .01$, and $p < .001$ level, as compared to the stimulant medication group. There was no change in cognitive and behavioural in the self-selected comparison group.

In an attempt to evaluate the task performance in the context of an assembly simulation in a virtual environment, Zhang, Fernando, Xiao, and Travis (2006) found that although introduction of auditory and/or visual feedback into the virtual environment did improve the task performance of the participants, integrated feedback (auditory *plus* visual) offered better assembly task performance than either feedback used in isolation.

In the current research, the researcher has adopted the visual, auditory and simulation technique, coupled with the systematic incremental approach (module to module) as an urgent need in fostering children's attention in a holistic, economical yet effective way of

promoting educational and instructional support which can facilitate children to be on-task. This system blends the multiple intelligences theory with the multisensory approach in the games to form a holistic system.

The system has various distinctive visual features, such that it incorporates multimedia flash, animation, colorful icons and background in each game. The auditory features include the enchanting background music, sound and motivational feedback. The simulation context allows children to immerse themselves in as natural environment as possible to allow for active participation in the games. It has meant to be less academic but task-oriented by taking into account the cognitive load of children with special needs and the mainstream children. The systematic incremental approach allows for paced and long lasting attention to be inculcated among these children. In addition to the above main features, other features such as fun, excitement, creativity, values, and adventurous were incorporated throughout the games.

Objectives

The objective of this study is to develop a courseware using Visual Auditory Simulation Technique (VASTech) that incorporates multimedia flash to systematically foster the attention for mainstream (3–6 years chronological) and special children (7–12 years chronological) so as to promote on-task behavior for effective learning.

Methodology

Research Design

This research adopts the non-equivalent control group design (for mainstream children) and pre-test-post-test control group design (for children with special needs) by using VASTech in promoting the on-task behavior of mainstream and special children. “On-task behavior” is shown when a child is engaged in or working on a specific task or activity. The frequency of on-task behavior before and after the intervention was recorded. The difference in the score of the task given before and after the intervention will determine the effectiveness of the courseware.

Sample

The sample consists of 54 children with special needs in which 24 children from the experimental group and 30 children from the control group. The total mainstream children involved were 55, where 20 of them were in the experimental group and 35 of them were in the control group. The age range for children with special needs and mainstream children is between 3 – 6 years old (mental age). The samples involved five centers for children with special needs and four centers for pre-schools for mainstream children which were located at Klang Valley, Malaysia.

The System

The content of the system have colorful, attractive, animated and in simulated context like in the garden, by the pond, on the beach, in the sea and in the cave. The system comprises three modules, namely, the beginner, the intermediate and the advance. Each module consists of five games. Each game differs from one to another in terms of the time frame needed to complete the game and its nature of complexity. The duration from each game was set in an incremental approach, which starts off with 1 minute for game 1, 2 minutes for game 2, 3 minutes for game 3, and so on, until game 15. The purpose of setting the short timeframe in

an incremental basis with speeded task is to allow gradual, systematic and long-lasting training of enhancing learners' attention when the tasks were given. Researchers in the area of attention have relied quite heavily on speeded task (Balota & Marsh, 2004).

Instruments

The activity worksheets are used to determine the effectiveness of VASTech by administering a pre-test before the experiment and a post-test after the experiment. The activity worksheets are the test papers which comprised tasks designed based on the cognitive function relating to attention ability and the applications underlying the task at hand to engage the children within timeframes. This was aimed to seek to channel the dynamism of the children on the task that the child was required to perform, to investigate how far the on-task behavior of the children were being promoted.

The tests used are adapted from one of the Fuerstein's Instrumental Enrichment assessment (Fuerstein, Falik, Fuerstein, & Rand, 2002) which is not tied up from specific subject matter but was used to develop children's ability to apply their cognitive functions to any problem and thinking situation.

There are two categories of tests to cater approximately for two groups of children. One is for children with special needs, while the other one is for mainstream children. Both groups of tests consist of pre-test and post-test. In each test, there are Test 1 and Test 2. Table 1 shows the specifications for each test designed for each specific category.

Table 1
The Test Specifications

Children with Special Needs		High Function Children with Special Needs and Mainstream Children	
Pre-test (Test 1)	Post-test (Test 2)	Pre-test (Test 1)	Post-test (Test 2)
Lattice dots 3X3 4 diagrams with vertical and horizontal lines needed to connect from dot to dot	Lattice dots 3X3 4 diagrams with vertical, horizontal and diagonal lines needed to connect from dot to dot	Lattice dots 4X4 4 diagrams with vertical and horizontal lines needed to connect from dot to dot	Lattice dots 4X4 4 diagrams with vertical, horizontal and diagonal lines needed to connect from dot to dot

Each effort to join a line from dot to dot is considered one task completed. In Tests 1 and 2 for children with special needs, each diagram will carry 6 points for 6 tasks required in each diagram. In Tests 1 and 2 for mainstream children, each diagram will carry 10 points for 10 tasks completed in each diagram.

In each category, the children's ability may vary; some children may not be able to accomplish tasks up to Test 2. Therefore, Test 2 is more on the extension from Test 1 if the child has no difficulty to complete Test 1. The scoring for each pre-test and post-test will be in percentage. In pre-test, the total points gain will be divided by the total number of tasks the child accomplished and then multiply by 100. The percentage is then used to compare in between pre-post test to determine the effectiveness of VASTech.

Data Collection Procedure

Both verbal and written consent had been obtained from the teachers and parents respectively after they have been provided with detail information. Pre-test and post-test were given to all the children with timing limited to 15 minutes each. The children were instructed to complete the tests individually without assistance from the researcher. All the test results were converted into percentage in pre-tests and post-tests for the purpose of comparison.

During the study, the children were allowed to engage with the computer individually under the supervision of the researcher in the school premise, isolated from other classroom children. Children were allowed to engage with the modules systematically from one game to another game within a module, then from module 1, 2 to 3. In each session, the researcher would call upon each individual for one game, until the child had fully achieved the target time engaging with the courseware. Then the next session would continue with Game 2 and so on. The visit to each centre was twice a week. Lastly, the post-tests were administered to the same set of the children who had sat for the pre-tests.

The control groups were undergoing learning by using the mainstream learning software, but were administered with the same pre- and post- tests prior to and after the experiment.

Result

Table 2 highlights the mean performance of both the experimental and control groups for mainstream children. The result shows that there is significant change in the performance from pre- to post-test for the experimental group, with $t=-8.97$, $p<0.05$; but not in the control group. This suggests that mainstream children who have undergone VASTech training were found to be more on-task as compared to those who did not undergo the training.

Table 2
Task Performance of Mainstream Children

Task Performance	N	Mean	*SD*	*t*	Sig
Experimental:					
Mean Pre	20	26.90	17.27	-8.97	0.000
Mean Post	20	62.80	10.53		
Control:					
Mean Pre	35	43.83	19.18	-0.34	0.737
Mean Post	35	44.86	18.34		

Table 3 highlights the mean performance of both the experimental and control groups for children with special needs. The seemingly lower pre-test scores in the control group as compared to those of the experimental group is unavoidable as children with special needs possess great diversity from each other albeit in the same category of special needs. The result shows that there is significant change in the performance from pre- to post-test for the experimental group, with $t=-3.69$, $p<0.05$; but not in the control group. This suggests that SEN children who have undergone VASTech training were found to be more on-task as compared to those who did not undergo the training.

Table 3
Task Performance of Children with Special Needs

Task Performance	N	Mean	*SD*	*t*	Sig
Experimental:					
Mean Pre	24	15.13	13.85	*-3.69*	0.001
Mean Post	24	25.42	20.78		
Control:					
Mean Pre	30	5.17	8.59	*1.09*	0.284
Mean Post	30	4.50	9.17		

From the qualitative view, children were very much attracted by the presentation of the VASTech with colorful animated and attractive interactive activities which were familiar to them and were user friendly. There were a few children with slight hyperactivity symptoms did not attract to the representation on the computer screen at the beginning. With the persistent effort of the child and the researcher, coupling with the attractiveness from the system, the computer session had finally become an attractive session for the children. The children were fully attracted to the activities at last.

VASTech intervention is effective as shown in the test results above. Children enjoyed during the engagement by the multimedia flash effect. It has reduced the anxiety of special needs children and also the very young mainstream children that they could be able to pay better attention to the task contrived in the process. Children with special needs might need special attention at the initial stages where instructors needed to monitor the engagement of the children so that they were not totally off-task in the process. Other very young mainstream children were sometimes manifesting the same behavior as the special needs children whereby they also needed special attention from the instructors to guide through the stages. Nevertheless, both targeted group of children had shown improvement in the post-test as compared with the pre-tests they had earlier done. This is to reinforce the effectiveness of VASTech that it might be able to replace medication and help the difficult children who face attention problem to regain confident in their ability to focus.

Discussion

If continuous attention to the stimuli or task is required once the stimulus has been caught, sustained takes over. To be effective as learners, students must develop the ability to maintain focus on incoming information over a sufficient period of time for effective cognitive processing to take place. At the same time, the learner must also withhold responses to incidental or non-relevant stimuli. Individuals should have developed the ability to maintain attention to a task for at least fifteen minutes to be effective at many schools and work activities. Krupski (1980) advocated that youngsters with learning disabilities, ADHD, or other disabilities seem to be particularly affected by problems with sustained attention and will often be observed making more responses to non-target stimuli over time. In this study, VASTech has taken this into consideration by allowing less non-target stimuli so that learners can engage on targeted stimuli as soon as he/she could.

The duration of each game in VASTech, has incorporated the concentration span of young children. Obviously, the ability to attend for significant periods is typically less

developed in very young children and many learners with disabilities. An appropriate diagnostic description of the attention attributes is essential to the development of effective educational programs for these students. Pre-schools and kindergarten programs are specifically designed to develop this ability by the early primary grades, because it is so essential to effective learning.

Barkley (2006) concluded that the lack of sustained attention or the lack of vigilance of effort is a central attribute of students with ADHD. Richard, Samuels, Turnure, and Ysseldyke (1990) investigated attention capabilities of students with ADHD, observed that students with ADHD seemed to have more difficulty with sustained attention, while those with learning disabilities were more likely to exhibit problem in selective attention. Hence, VASTech serves to enhance selective attention by having numerous enhanced features and reduced non-target stimuli as well as to enhance sustained attention by reducing the misbehavior of these children.

Recommendations

Since attention is the foundation for all learning, it is therefore essential that attention be trained in the early developmental stage for children, be it for mainstream children or children with special needs. This will help tremendously in promoting children's holistic development and assist them in the transition from pre-schooling to normal schooling.

An appropriate diagnostic description of the attention attributes is essential to the development of effective educational programs for these students. Pre-schools and kindergarten programs need to be specifically designed to develop this ability by the early primary grades, because it is so essential to effective learning.

The development of VASTech as a form of game-based learning for mainstream children and children with special needs has been effective in promoting on-task behavior through the incorporation of various elements such as visual, auditory, simulation, as well as other features such as color, animation, task-oriented, and tactile. It is also rare to discover in the available market that computer courseware is being used for intervention purposes. In view of the inadequacy, the present software serves as an important intervention tool to help in children's foundation aspect of learning.

The use of VASTech as a form of assistive technology can greatly enhance the many aspect of learning through the incorporation of multisensory approach and multiple intelligences which demonstrate greatly that theories are put into practice to allow for effective learning, in this case, the development of children's on-task behavior will directly reduce the chances of children being off-task, hence, allowing maximum engagement during learning.

Conclusions

As a conclusion, both the attention skills of mainstream children and children with special needs can be trained in the environment of learning which takes into consideration of multiple factors such as the child, the task and the tool used by the educators. The mainstream children were found to have a bigger magnitude of improvement in their on-task behavior as compared to those of the special needs children probably due to the fact that children with special needs display comorbid behavior more frequently than mainstream children. Nevertheless, as early childhood care and provider as well as professionals, the intention is always to improve children, especially children with special needs' access to early childhood education through practical, non-traditional and innovative delivery modalities.

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