FACILITATING DEAF FILIPINO LEARNERS' COMPREHENSION OF WHOLE NUMBERS USING TRADITIONAL AND ANIMATED LEARNING TOOLS

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This study investigated the difference in traditional and animated instructional tools in teaching whole numbers to deaf students. This also determined the capacity of animation to aid comprehension of technical concepts in Mathematics of deaf learners. Two groups of grade 1 Deaf Filipino students from public schools were exposed to the topic of whole numbers for 10 weeks. To check for prior knowledge and learning, both groups underwent pre and post assessment using the Comprehension of Whole Numbers Test (CWNT). One group (n=8) was exposed to lecture with limited visual aids while other group (n=9) was exposed to educational media called Animated Teaching Tool (ATT). Using Mann-Whitney U Test, key results revealed that those exposed to ATT showed higher post-test mean in their CWNT when recognizing cardinal numbers. However, the groups did not differ significantly in reading and writing numbers in symbols and words; reading and writing ordinal numbers; and reading and writing money. The results also revealed that students exposed to ATT manifested significant difference in their pre-post-test scores in whole number topics in recognizing cardinal and ordinal numbers as well as reading and writing money. It is concluded that ATT can aid the comprehension of Deaf Filipino Grade 1 students when teaching whole numbers.

It is necessary in Deaf education to make technology integral to the learning process because of strong connection between multimedia presentation and information. It also encourages more engagement from users (Gentry, Chinn, & Moulton, 2005 as cited in Smith, 2009). A student's motivation and comprehension can improve significantly with teaching materials designed for both visual effectiveness and content (Toledo, 2010). Researchers like Kara(2008), Steel (2006),Villaruz (2005) and Reyes (2003) found that visual materials should be selected based on how effective they can bring total quality education, a desired learning outcome. Results can empower students to make decisions accurately and comprehend information through immediate and intellectual tools and applying what they learned to their day-to-day lives. In a study by Subrahmanyam and Greenfield (2008) through picture sequencing, television viewing yielded better performance than purely auditory cueing of material. This highlights the fact that television viewing stimulates visual representational processes.

Visual learning is further validated by different approaches in print and video presentation. An effective teaching material is done through video animation which not only promotes instructive but also interactive means of teaching and learning. Animated objects/people, furthermore, allow the students a permissible way of pleasurable learning as shown in its colorful and realistic aspects.

According to Subrahmanyam and Greenfield (2008), video/television viewing can lead significantly to better performance. This means better recall of information, greater focus on action representation for children to learn a concept through video/television. Thus, the use of animated teaching tool came to mind in teaching deaf children, since the researcher has interest on how the Deaf can learn well.

The Deaf curriculum in the Philippines needs significant improvement as it is currently patterned after that of the regular Grade 1 students in which the deaf students' level of comprehension and difficulty is inappropriate. In this study, the researcher aimed to make an animated teaching tool that can help improve the mathematical comprehension skills of Grade 1 deaf students in the public schools. The animated teaching tool used Filipino Sign Language (FSL) as a teaching medium.

COMPREHENSION OF WHOLE NUMBERS

The word 'hierarchy' applies to how and in what order children learn mathematics (Hart, 1981). "Hierarchy" implies a string of skills/levels/stages/concepts. These concepts are ordered from simple to complex. In learning the comprehension of whole numbers, children should first learn its foundation.

According to Piaget, as cited by Smith (2006), physical knowledge of colors, sizes, shapes, and textures can be used and form the base to construct logico-mathematical knowledge. Logico-mathematical knowledge is an important relationship in mathematics that creates the early foundations of mathematical thinking. Teachers who understand the foundations of early mathematics should develop a curriculum steeped with challenging problem-solving activities at the children's levels. Lack of knowledge of these early mathematical concepts can result in rote learning skills such as counting, writing numerals, and finding the number of objects in a set. Furthermore, lack of development of these areas of logical thinking during the child's formative school years may indicate a lag in a child's development (Smith, 2006).

With good foundation, children will discover how easy it is for them to learn the succeeding concepts like recognizing cardinal numbers, reading and writing number in symbols and words, reading and writing ordinals, and money. These are concepts which children must learn in their first grade level for them to have a better comprehension of whole numbers.

DEAF CHILDREN AS VISUAL LEARNERS

The Deaf are noted to be visual learners according to different studies like to Bahan, as cited by Reeves (1995), American Sign Language was developed not because deaf people can't hear, but because they can see. Deaf people are primarily visual beings. Their eyes are their portal to the world of information and knowledge (WFD Policy Statement, 2007). In a study conducted by Bustos (2007), it was highlighted that the Filipino deaf children's literacy behaviors tend to be more inclined to visual learning.

According to Lane (1999), children who are visual learners or with visual-spatial skills are more inclined to make drawings – drawing maps, folding papers, and doing jigsaw puzzles, thus can be taught through drawings, visual and physical imagery. Highly effective tools for teaching children with strong visual-spatial abilities that include models, graphics, charts, photographs, drawings, 3-D modeling, videoconferencing, television, texts with pictures/charts/graphs, multimedia and video (Lane, 1999).

VISUAL LEARNING THROUGH ANIMATION

Animation is not simply drawing or the act of creating the images that are viewed but it is the arrangement of images. It is the sequencing of static images to convey motion (Corsaro, 2002).Animation is essentially a better tool than live action because it gives greater creative freedom and offers a different vocabulary of expression. It gives a greater degree of control over the construction of the work; therefore, its outcome. Animation can offer a different representation of 'reality' or create worlds that children can easily relate to. Animation puts the unimaginable visually at work which children will be appreciated and loved (Wells, 2006).

RESEARCH PROBLEMS

This study answers the following questions:(a) do Grade 1 deaf students, exposed to the Animated Teaching Tool, have higher change in comprehension of whole numbers than those exposed to the Traditional Teaching Tool? (b)what are the students' reactions regarding the Animated Teaching Tool? (c)what specific features are to be considered in designing the Animated Teaching Tool to be used in teaching whole numbers to Grade 1 deaf students?

METHOD

Participants and design. The study used quasi-experimental design with pre-post-test control group to determine significant difference in the comprehension of whole numbers. This study had 17 participants randomly assigned to experimental (n=9) and traditional (n=8) groups. Both groups were Grade 1 deaf students from public schools and

their level of deafness is from severe to profound. Their ages are from six years old to twenty-two years old.

Instruments and procedure.The comprehension of whole numbers test (CWNT), a 30-item researcher made test, was used as pre-post-test measure of what the deaf students know/learned about whole numbers. The researcher also used lesson plans and worksheets composed of 17 lesson plans based on the grade 1 Mathematics adjusted curriculum from the Philippine Basic Education Curriculum of the Department of Education focused on comprehension of whole numbers. The lessons were administered to the 2 groups for 10 weeks. The instructional tool of animated teaching tool (ATT) was created that correspond to the 17 topics of comprehension of whole numbers and this was given to the experimental group as supplement for the lecture on the 17 topics. For the traditional group, regular lecture and visual aids were used. Individual activities were presented through worksheets for both groups, which assessed students' performance in all the topics under Comprehension of Whole Numbers. All observations relating to the comprehension of mathematics concepts were recorded for both groups as well as results of worksheets and tests given to the students.

RESULTS

Effects of the Tool on Comprehension of Whole Numbers

Table 1

Scores of the Participants in CWNT

Participants	Pretest score (%)	Posttest score(%)	Change in score(%)
Experimental 1	11 (36.67)	22 (73.33)	11 (36.66)
Experimental 2	8 (26.67)	22 (70.00)	14 (43.33)
Experimental 3	8 (26.67)	21 (66.67)	13 (40.00)
Experimental 4	15 (50.00)	29 (96.67)	14 (46.67)
Experimental 5	13 (43.33)	23 (70.00)	10 (26.67)
Experimental 6	14 (46.67)	26 (86.67)	12 (40.00)
Experimental 7	11 (36.67)	21 (66.67)	10 (30.00)
Experimental 8	15 (50.00)	22 (70.00)	7 (20.00)
Experimental 9	6 (20.00)	23 (76.67)	17 (56.67)
Traditional 1	16 (53.33)	23 (76.67)	7 (23.34)
Traditional 2	16 (53.33)	18 (60.00)	2 (6.67)
Traditional 3	15 (50.00)	21 (70.00)	6 (20.00)
Traditional 4	15 (50.00)	20 (66.67)	5 (16.67)
Traditional 5	15 (50.00)	22 (73.33)	7 (23.33)
Traditional 6	19 (63.33)	26 (86.67)	7 (23.34)
Traditional 7	16 (53.33)	26 (86.67)	10 (33.34)
Traditional 8	12 (40.00)	20 (26.67)	8 (26.67)
Mean pretest score:	Experimental = 11.22; Traditional = 15.50		
Mean posttest score:	Experimental = 23.22; Traditional = 22.00		
Mean change in score:	Experimental = 12.00; Traditional = 6.50		

Students from the traditional group (m = 15.50) got higher pretest mean scores than the students from the experimental group (m =11.22) (refer to Table 1). This shows that the students from the traditional group have more prior understanding of topics in the Comprehension of Whole Numbers than those from the experimental group. After the treatment, posttest mean scores for both groups are higher than their pretest mean scores. The differences between posttest mean score and pretest mean score for both groups are

significant (p< .05). It is worth noting that the change in score for the experimental group is higher than that of traditional group (refer to Table 1).

Table 2

Significance Results of Change in Score of CWNT

	Change_in_Score
Mann-Whitney U	8.000
Wilcoxon W	44.000
Z	-2.706
Asymp. Sig. (2-tailed)	.007
Exact Sig. [2*(1-tailed Sig.)]	.006[b]

a. Grouping Variable: Group
b. Not corrected for ties.

The researcher used the Mann-Whitney Test to determine the significant difference between changes in the pretests and posttests scores of the two groups. The results revealed that there is a statistically significant difference in the change scores of the two groups (U= 8, *p*= .007), refer to Table 2. This implies that Grade 1 deaf students who were taught using animated teaching tool had greater change in score in Comprehension on Whole Numbers Test than those taught using the traditional teaching tool.

Comprehension of Whole Numbers by Concept

The researcher also looked into the change of scores in Comprehension of Whole Number Test per topic within and between the groups.

Table 3

Wilcoxon Signed Rank Test Significance Results of Pretest and Posttest Scores in CWNT of the Two Groups Per Topic

	Recognizing Cardinal Numbers			Reading and Writing Numbers in Symbols and Words			Reading and Writing Ordinal Numbers			Reading and Writing Money		
Group	mean pre test score	mean post test score	*p* -value	mean pre test score	mean post test score	*p* -value	mean pre test score	mean post test score	*p* -value	mean pre test score	mean post test score	*p* -value
Experimental n=9	8.56	14.11	0.008	2.00	2.56	0.129	0.84	2.33	0.018	0.22	3.56	0.007
Traditional n=8	11.88	13.13	0.176	1.50	1.50	0.102	1.00	2.63	0.022	1.13	3.88	0.011

Table 3 shows the results of the significant difference between pretest and posttest scores of CWNT per topic for the two groups using Wilcoxon Signed Ranks Test. In the experimental group, the change in scores was significant (p<.05) in topics Recognizing Cardinal Numbers (Z = -2.67, p = 0.008), Reading and Writing Ordinal Numbers (Z = -2.36, p = 0.018), and Reading and Writing Money(Z = -2.687, p = 0.007) . While in the traditional group, the change in scores was significant in topics Reading and Writing Ordinal Numbers

(Z = -2.297,p = 0.022)and Reading and Writing Money (Z = -2.536,p = 0.011). Therefore, it shows that the Grade 1 deaf students for both groups improved their comprehension in whole numbers but not in all areas.

Table 4

Significant Results of Change in Score in CWNT Per Topic Between the Experimental and Traditional Groups

	Recognizing Cardinal Numbers			Reading and Writing Numbers in Symbols and Words			Reading and Writing Ordinal Numbers			Reading and Writing Money		
Group	mean pre test score	mean post test score	*p* - value	mean pre test score	mean post test score	*p* - value	mean pre test score	mean post test score	*p* - value	mean pre test score	mean post test score	*p* - value
Experimental n=9	8.56	14.11	0.027	2.00	2.56	0.815	0.84	2.33	0.743	0.22	3.56	0.321
Traditional n=8	11.88	13.13		1.50	1.50		1.00	2.63		1.13	3.88	

Table 4 shows the significant change of scores of CWNT per topic between the two groups using Mann-Whitney Test. The only topic which has a significant result (p < .05) is Recognizing Cardinal Numbers (U = 13.5,p = 0.027) implying that the overall performance on the test was determined by this subtest. This result was probably due to the fact that few sessions were allotted to the three other areas in the curriculum. With this, it only showed that animated teaching tool is more effective than traditional teaching tool in topic Recognizing Cardinal Numbers from 0 to 50 and not in other areas.

DISCUSSION

The overall results of the Comprehension of Whole Numbers Test (CWNT) proved that there was an improvement in the scores of the group exposed to animated teaching tool. However, it was noticeable that some students had difficulty in remembering the correct spelling of number words, ordinal numbers and money. Also, results proved that by viewing an animated teaching tool, deaf students are aided to improve comprehension. This outcome is same from the study by Subrahmanyam and Greenfield (2008) which showed the positive effects of adding moving visual imagery to an audio narrative of a story. It further showed that video/television viewing leads to significantly better performance proving technology as both enhancing and essential in teaching and learning mathematics. Studies made by Charlesworth and Lind (2010); Parton, Hancock, Craig-Dorough and Oescher (2009); and Smith (2009) support this point.

It was observed that the students gravitated towards the interactiveness of the tool. This was complemented by the colorfulness of the tool which enticed the students. When Deafy signs, the students tend to copy. This reaction from the students resulted to multiple viewing (replays) for students who were not able to understand the lesson at the first viewing.

The effectiveness of an animated teaching tool comes from its colorfulness, magical effects, very realistic signing and very cartoony. These features are highlighted to get the student's attention and help them learn Math better. Raugust (2007) supports this by emphasizing that motion should be very realistic and animation should be colorful, cartoony and stylized for children to gain interest on the presentation.

CONCLUSIONS AND IMPLICATIONS

Based on the findings of this study, it is concluded that the Animated Teaching Tool aids in the comprehension of whole numbers specifically recognizing cardinal numbers among deaf Grade 1 students as shown in the higher change of score. Moreover, it helps keep deaf students attentive, motivated, competitive, active and confident when learning whole numbers. The features of the Animated Teaching Tool enabled deaf students to pay closer attention and learn Mathematics better.

In the Philippine setting, regular curriculum is used in teaching the Deaf, hence there is a need to modify the current curriculum. There should be more innovative means in teaching the deaf students. The visual learning capacity of Deaf children should be prioritized. Therefore, the researcher recommends that the Animated Teaching Tool be utilized in teaching the basic concepts of Mathematics and improve the material to facilitate learning.

It is also recommended to validate the results with bigger sample to see the possible generalization on the effectiveness of this method of instruction for deaf students. The researcher also recommends a continuing creative endeavor among teachers and animators and the Deaf community to come up with well researched animated teaching tool for deaf children in teaching other concepts in Mathematics.

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