Journal of Inclusive Education
Vol.4, Issue 1, 2020, 195-210

Teaching of Science to Students with Hearing Impairment with Demonstration Method in Inclusive Education Setting

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Abstract

This study measures the effectiveness of the demonstration method in teaching Science to pupils with hearing impairment in an Inclusive setting. Forty students were selected for the pilot study to check the validity and reliability of the instrument. After the Pre-test, the control group and the experimental group were selected. The demonstration method was applied to the experimental group, whereas no treatment was applied to the control group. The sample comprised thirty students. The experimental group was given treatment for five weeks. The post-test of both groups was taken to measure the effectiveness of the demonstration method in teaching science to students with hearing impairment after the treatment. An independent sample test was taken before and after the intervention to differentiate between the two groups. There were significant differences between both groups' scores on the post-test. The results suggest the demonstration method as an effective way to teach science subjects to the hearing-impaired students in an Inclusive Setting.

Keywords: science, scientific literacy, science concepts, the demonstration method, hearing-impaired children.

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Introduction

Science is one of the significant subjects in human life which is taught at institutions. Science has great importance not only in human lives, but also in academics. This subject is necessary for the growth and development of the minds of students with and without disabilities. Children with disabilities also get benefits from science education to improve functioning in particular areas of disability. Students with hearing impairment and physically impaired are recommended science education for improving their compensatory skills. According to Kyle (2000), Science is a fascinating subject that has significance in an excess of the world situation around them to understand. It provides contentment as well as responses to the queries arising in the minds of hearing-impaired children. It helps them to make better adjustments in society. It enriches the skills of imagination which helps individuals to solve problems in different areas of literacy, communication, reasoning, generalization, and critical thinking (Wells, 1994).

Science is an organized process of attaining knowledge through observation and investigation to describe natural occurrences. Researchers have largely agreed that science can play a significant role in the learning experiences of hearing-impaired children. It expands their knowledge in science as well as their self-identity and self-confidence (Cahn, 2006).

According to the study by Brown, et al., (2002), the student-based problem-solving method was found to be primarily useful in developing students' thinking skills and problem-solving abilities. As David Martin (2011) said that students are genuine scientists, they discover the world as soon as they start discerning the world around them. Jean Piaget in his theory states that students are at a tangible academic functioning stage when they are in elementary grades. This offers a ground reality that at the elementary level students can be provided support and provision to develop problem-solving and acute thinking skills in later life (Chylinski, 2004). Furthermore, according to Piagetian principles, learning is based on an active process, making errors, direct experience, solve problems, think, and communicate. Therefore, the child’s learning

system of cultural communication and cognitive development is necessary to gain actual knowledge which is required (Graham, 2005).

According to AAAS (2010), the apparatuses of scientific inquiry are: to be aware of the natural world, to consider key scientific impressions and principles using scientific thinking methods, and to use scientific knowledge and thinking methods for expert decisions. Build of scientific knowledge is a compound process that emphasizes the assignation of students. When students know what they are learning, they become interested in science and learn more effectively. And when they learn with interest, they investigate, read, observe, take field notes, and use visual aids.

Changing teachers' attitudes toward teaching strategies improve the learning process by meeting the special needs of a child with a disability. Mundi (2006) states that the method of demonstration is a show or a presentation that teachers usually present, and the students observe it with attention. He describes the teacher as the main artist whom students see so they can act in the same way later.

The demonstration is an effective approach to explain scientific concepts to students. It is an important factor that instructors use this strategy correctly. The demonstration method to teach hearing-impaired students is being taught to provide an opportunity to observe and understand the details regarding the subject. It is a step-by-step process of teaching by using posters, PowerPoints, flip charts, etc. It can be used in teaching science to achieve several commitments. It can be used at the beginning of a new lesson or unit because when it is arranged at the beginning, it will create curiosity and interest in the students.

The demonstration is a significant method for science teaching as science is not only a theory subject but has a wide quota of hands-on work also. By carrying out effective demonstration activities in the teaching process, a teacher can provide tangible experiences to the students. Through this method, students get views to play an active part in the learning process, as a result of which their aptitudes of inquiry and reasoning get exercised and established properly. While according to Arubayi (2009), a noticeable presentation of ideas, skills, arrogances, manners, and other intangibles is done in a defined demonstration method.

Lesson planning should be done before the presentation in the demonstration method and all the essential equipment and materials required for the lessons should be available. Simple and clear orders should be given to contributors. Seating should be arranged in such a way that students do not have any difficulty in seeing and hearing the demonstration. After the demonstration, an effort should be made to give students the opportunity to practice, either individually or in groups. Teachers should help and supervise students who do not yet comprehend the basic concept well.

There are many advantages and disadvantages to using demonstration methods to teach science. One of the major benefits of this is that it helps in learning as students see, hear, and do. However, improper planning and poor performance of lessons will not lead to significant results and may even discourage this method of excellent learning.

IDEA defines hearing-impairment as "an impairment in hearing, whether permanent or fluctuating, that adversely affects a child's educational performance" and deafness as "a hearing impairment that is so severe that the child is impaired in processing linguistic information through hearing, with or without amplification." Hearing impairment can therefore be seen as a condition that allows an individual to respond to auditory stimuli and speech. On the other side, a deaf person can't receive a sound at all (Moores, 2001).

Science is very important in the subjects taught to disabled students (Patton & Andre, 2006). There are many other benefits to teach science to students with disabilities such as increasing practical background for students with improper skills, casing skills essential for mature work, using tangible and practical learning practices, and learning of cognitive skills (Patton & Andre, 2006; Esler, Midgett, & Bird, 2000; Mathias & Johnson, 2002). Finally, teachers have recognized science as the most agreeable subject area for mainstreaming students from all categories of disabilities (Atwood & Oldham, 2005).

Methodology

Research Design

The design of the study was truly experimental. It was decided to use the demonstration method, so it was necessary to select a homogenous group through a random sampling technique. Figure 1 shows the systematic description of the design.

Figure 1: Pre-test post-test control group design

The researchers selected this design based on the nature of the problem. There were two groups in the study design: the treatment group and the control group, and each group comprised fifteen students. After teaching the control group with the traditional teaching method and treating the experimental group with the demonstration method, the post-test was administered. There are several inherent weaknesses in a pre-test and post-test experimental design. Internal validity suffers from many threats such as history, maturation, instrumentation, experimental mortality and regression (Campbell & Stanley, 1963). Whenever a researcher uses an intact group instead of taking random samples, he/she always encounter these threats. However, since there was no significant difference between both groups as shown in Figure 1, and the researchers instructed them simultaneously, it can be supposed that the instrumentation effect can be ruled out.

Population

The target population of the study included all hearing-impaired students who were studying in grade IV at primary schools in the different schools set up in Lahore.

Sample and Sampling Techniques

The sample of this study comprised grade IV students enrolled in Government Deaf and Defective Hearing High School Gulberg, Lahore. Student's list from the class teacher was obtained. There was no gender diversity as the study was conducted in a boys' school. At the start, all the students were studying in the same class. However, based on the pretest score, the researchers divided them into two groups, the control group and the experimental group. For this division, the researchers used a systematic sampling technique and added every second member on the score list to the control group, as shown in figure 2.

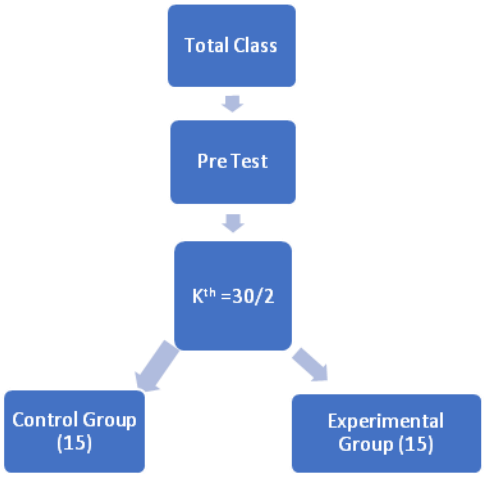

Figure 2: Systematic Sampling for the Control Group and the Experimental Group.

Though, it is considered that a systematic sample is a simple technique of random sampling (Gay, 2012), the researchers used it for selecting a study sample as one cluster was split into two groups. Table 1 assigns control and experimental group to students. This method was also considered to be enough to ensure a certain degree of homogeneity. The disadvantage of the systematic sampling technique is that it allows the selection of each K^{th} member after the first K^{th} member has been determined

(Gay, 2012). However, because the researchers organized the students according to their roll numbers and gave them scores based on tests, the chances of students with high or low grades gathering on one side of the pool were very low. Thus, to a certain extent, researchers managed to avoid predicting K^{th} numbers.

The final study sample consisted of 30 grade IV students enrolled in Government Deaf and Defective Hearing High School Gulberg Lahore. There were 15 students in the experimental group and 15 in the control group.

Table 1

The control group and the experimental group

Sr.no	Group	Sr.no	Group
1	C	16	E
2	E	17	C
3	C	18	E
4	E	19	C
5	C	20	E
6	E	21	C
7	C	22	E
8	E	23	C
9	C	24	E
10	E	25	C
11	C	26	E
12	E	27	C
13	C	28	E
14	E	29	C
15	C	30	E

*C = Control Group

*E = Experimental Group

Procedure

To measure the effectiveness of demonstration methods in science teaching, a science test was needed to develop to measure the success of hearing-impaired students. The schools of hearing-impaired students were personally visited by the researchers to discuss the content for the experiment with the class teachers of the students concerned. So, the test was administered. The test was developed by the researcher based on the literature review under the guidance of relevant teachers and the content of the book of science of the Punjab Textbook Board for grade IV, which was being taught in all special education schools.

Validity of the Test

After the items were constructed, the test was discussed with the experts, psychologists, speech therapists, and teachers. It was shown to fifteen experts, including three psychologists, three speech therapists, and nine teachers of the hearing-impaired students. The experts were requested to assess the items in terms of their language, level of complexity, and relevance of the content. Following a modification based on experts' opinions, the test was chosen for pre-testing.

Table 2

Frequency and percentage of the stud14ents with hearing impairment for the pilot study

Sr.no	Institution		
1.	Government Central High School for Deaf, Gulberg	4	5
2.	Government Deaf and Defective Hearing High School for the girls, Rajgarh	6	5
	Total	0	00

Pilot-Testing

The pilot-testing was intended to assess the test reliability. Ten questions of different items were developed for the pilot test through consultation with expert teachers. Students of grade IV of two following schools were selected for pilot-testing.

Reliability of the Test

The researchers used Cronbach's alpha to find out the test reliability. For this purpose, the instrument was administered to a sample of 40 students with hearing impairment. The Cronbach's alpha for the pre-test was 0.72. After the pilot-testing, a test was finalized to make the experiment. The researchers applied that test as a pre-test and post-test to measure the effectiveness of the demonstration method in teaching science to hearing-impaired students in grade IV.

Experimentation

Control group teachers taught them using conventional teaching methods. Teachers traditionally instructed students through the class routine, timetable, textbook, and whiteboard. Also, the group was given daily homework from the content. The experimental group was given independent variable treatment for five weeks using the demonstration method. Each group was given a 45-minute class. There were four classes per week. Demonstration method lessons were presented to the experimental group using visual images such as real models, PowerPoint presentations, videos, charts. The students also performed activities during the experimental phase. These activities were designed to improve the learning experience, the spirit of learning, and scientific literacy in students with hearing impairment.

Results

Using the t-test and achieved scores, the researchers found significant differences in the mean of the scores of both groups.

Table 3

Independent Sample T-test comparing the performance of groups on the pre-test

	N	Experimental Group		Control Group			
Pre-test		Mean	SD	Mean	SD	t	p
	30	66.80	9.528	71.83	11.623	1.297	.206

Table 3 indicates that the difference between the control group and the experimental group (p=.206) was not significant, which revealed that their level of achievement was equal prior to intervention.

Table 4

Independent sample t-test comparing the performance of groups on the post-test

Post-test	Experimental Group		Control Group			
	Mean	SD	Mean	SD	T	P
	90.16	3.22	89.85	4.83	.211	.834

After the post-test, a significant difference (t =. 211, sig =. 834) was observed between the two groups, indicating better performance of the experimental group than that of the control group.

Table 5

Independent sample t-test comparing the performance of groups in gain scores

Total Gain Score	Experimental Group			Control Group			
	N	Mean	SD	Mean	SD	T	P
	30	23.36	8.46	18.01	8.90	1.687	.103

Table 5 shows a substantial difference (t= 1.687, sig=.103) between the scores gained by the two groups, which reveals the improved achievement level of the experimental group (Mean=23.36, SD= 8.46) compared to the control group (Mean=18.01, SD= 8.90).

Table 6

Paired sample t-test comparing the performance of the experimental group on the pre-test and post test

Experimental Group	N	Pre-test		Post-test			
		Mean	SD	Mean	SD	T	P
	30	69.31	10.75	90.00	4.04	-12.65	.000

The researchers administered a paired sample t-test to find out how the intervention affected the experimental group's achievement scores. Table 6 indicates a substantial difference in the achievement scores of pre-tests (M= 69.31, SD= 10.75) and post-test (M=90.00, SD=4.04), t (-12.65), p=.000.

Discussion

The researchers conducted this experimental study to examine the effectiveness of the demonstration method in teaching science to hearing-impaired students in an Inclusive Setting. To this end, the performance of the two groups (the control and the experimental group) was compared. The performance of both groups was almost similar in the science test before the intervention.

Adopting the demonstration method, a strategy of using visual images and visual media was used to improve the scientific conceptions of students with hearing impairment. The first part of the post-test showed that the experimental group on the title of "the plant life cycle" performed better than the control group in ticking the correct answers, matching the columns, and filling the blanks.

The second part of the test also found the experimental group's better performance compared to the control group. This section contained naming the directions, matching with images, and separating vegetarians, omnivores and herbivores.

The 3rd part of the test examined both groups through items of separating simple and engine machines, old and modern tools, and balanced diet names. The results showed that the demonstration method significantly affected the experimental group and as a result, it performed better than the control group.

On the one hand, the study indicated that an effective method of teaching science to hearing-impaired students is needed, and on the other hand, it found that the demonstration method is very effective in teaching science to these students.

These findings are consistent with previous investigations elsewhere (Schirmer, 2000, Marschark, 2005, Huntington et al, 2002, Williams et al. 2003, Easterbrooks & Baker, 2002). Further studies are needed to find and generalize more aspects of the demonstration method so that the study horizon can be broadened in terms of disability levels, student grades, and various academic disciplines.

Conclusions

The role of science in human life is very important. Therefore, educational institutes consider science the most important subject. Science subjects are equally important for the development and growth of the minds of students with and without disabilities. Children with disabilities must get benefits from science education to improve functioning areas of disability. Changes in teachers' teaching strategies improve the learning process while meeting the special needs of a child with a disability. One of the major benefits of adopting the demonstration method is that it helps a lot in learning as it not only allows the students to see and hear but also to practice. However, lack of planning and poor performance will not encourage better learning of lessons and may not allow for individual change.

Recommendations

Based on the research findings, the researcher has made the following recommendations for further research:

1. The demonstration method should be used by teachers to develop scientific concepts in hearing-impaired students in an inclusive setting.
2. Teachers should have a responsibility to provide opportunities for pupils with hearing impairment to get knowledge by practically doing to clear scientific concepts.
3. Awareness programs can be launched to educate parents, teachers, and other members of the community that hearing-impaired students have the ability to learn scientific concepts.
4. The findings of various studies should also be considered by textbook authors and curriculum developers in the design and production of textbooks for students with hearing impairment.
5. Science teachers of hearing-impaired students should be given special training so they can use the advanced instructional material, modern teaching strategies, and lab equipment effectively.
6. Further studies should be conducted to find out the effectiveness of demonstration methods in different educational fields for students with special needs.

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Citation of the Article:
Ahmed, L., Bokhari, A., & Waqar, F. (2020). Teaching of Science to students with hearing impairment with demonstration method in inclusive education setting. *Journal of Inclusive Education, 4*(1), 195-210.

Received on: 2nd Oct, 2020
Revised on: 3rd Dec, 2020
Accepted on: 3rd Dec, 2020