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The Effectiveness of Inquiry Based Learning Model of Student with Hearing Impairment in Science Subject

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Abstract & Indexing

Abstract

Inquiry-Based Learning (IBL) has emerged as an effective teaching model across various educational disciplines and has recently gained attention in the field of special education. This study investigates the impact of IBL on the academic performance of hearing-impaired students in science compared to the traditional teaching method. An experimental research design was employed, involving 30 hearing-impaired students divided equally into an experimental group, which received instruction through the IBL method, and a control group, which followed the traditional teaching approach. A teacher-made test, validated by special education experts, was used as the research instrument. Both groups were taught the same science content over a four-week period, followed by a post-test to assess learning outcomes. The data were analyzed using inferential statistics, specifically the t-test, to compare the performance of both groups. The results revealed that the experimental group significantly outperformed the control group in developing scientific concepts. These findings highlight the effectiveness of the IBL approach in enhancing the academic performance of hearing-impaired students in science. The study recommends further research to explore the application of IBL in other subjects and emphasizes the need for providing resources and training to teachers to facilitate the integration of IBL in special education classrooms.

Keywords

Inquiry-Based Learning, Traditional Method, Student with Hearing Impairment, IBL Approach.

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1. Introduction:

In today's age of information and technology, where scientific understanding advances rapidly alongside technological breakthroughs, it is evident that science education and technology are crucial for the future of societies. The impact of science and technology are clearly observable in every aspect of existence (karamustafaoglu, 2010). Inquiry method has an important place among different kinds of methodologies. The most recent educational strategy i.e. Inquiry-based learning involves students engaging in methods and practices similar to those employed by professional scientists to develop their understanding (Keselman, 2003). This approach can be characterized as a technique for discovering new causal relationships, wherein learners formulate hypotheses and test them through experiments and/or observations (Pedaste, Mäeots, Leijen, & Sarapuu, 2012). This approach is particularly beneficial for hearing-impaired students as it allows them to engage with scientific concepts and ideas in a hands-on, interactive way that can help to make the learning experience more meaningful and engaging. Inquiry-based learning focuses on the active involvement of learners and their accountability in uncovering new information (de Jong & van Joolingen, 1998). During this approach, students typically engage in a self-driven learning process that combines both inductive and deductive methods by conducting experiments to explore the relationships between at least one set of dependent and independent variables (Wilhelm & Beishuizen, 2003). Often it is viewed as a problem-solving approach and includes several problem-solving skills applications (Pedaste & Sarapuu, 2006). The 5E's of the Inquiry-Based Instructional Model is founded on principles of cognitive psychology, constructivist learning theory, and effective practices in STEM education (Bybee 2009). This model guides students through five distinct phases: Engage, Explore, Explain, Elaborate, and Evaluate. The 5E Instructional Model provides a cohesive framework for various teaching strategies and is interconnected with educational activities. Additionally, it assists science educators in facilitating interactions with researchers (BSCS 2019). According to Bybee 2009 inquiry-based learning cycle results in better benefits about students' aptitude for scientific review over traditional learning.

Engagement

The student centered stage of this Learning process is engagement. In this stage teacher measures the previous knowledge of student and/or detects potential errors (Duran 2004). It should generate a wish to learn more innovative upcoming topic. According to Duran (2004), it is not planned for the teachers. Teachers provide lectures, define terms and explanations.

Exploration

The second stage of inquiry model exploration, provides practical activities students. These activities/doings will assist students use gained inquire information to generate new concepts, and conduct a introductory study (Bybee 2009). By Duran 2004, this phase usually integrates the main inquiry-based experience, which develops students' understanding.

Explanation

The teacher-directed Explanation stage in the educational model is directed by the students' experience in the exploration phase (Duran 2004). According to Bybee 2009, students clarify their understanding of concepts and correction of students' misconceptions. The teacher may offer formal definitions, notes, and label during this phase.

Elaboration

Students are encouraged to apply their newly acquired knowledge of concepts while developing new skills (Duran, 2004). As noted by Duran (2004), "Students may conduct additional investigations, develop products, share information and ideas, or apply their knowledge and skills to other disciplines" (p. 53). This phase of the instructional cycle offers opportunities for educators to integrate science with other subject areas (Duran, 2004).

Evaluation

According to Bybee (2009), "The evaluation phase encourages students to assess their understanding and abilities and provides opportunities for teachers to evaluate student progress toward achieving the educational objectives". Both formative and summative assessments are suitable during this phase. Duran (2004) provides a compilation of alternative assessment methods, such as evaluating students' comprehension and performance through portfolios and performance-based assessments. The list also includes tools like concept maps, physical models, and journal logs.

According to Prince and Felder (2007), the Arends Inquiry strategy is a good choice for use when trying to gain a deeper grasp of a subject. The learning paradigm emphasises projects, problems, inquiry, creativity, and creation (Berberoglu, G. 2014). Therefore, Arends (2011) lists a few effective teaching methods that can be used in the present-day inquiry-based learning, traditional method and problem-based learning (PBL). This empirical conclusion suggests that an inquiry is necessary for any learning technique. As a result, using an inquiry technique to teach students a concept makes sense when considering constructivism philosophy. As a result of the advantages, it has for the growth of conceptual knowledge and the use of cognitive strategy in problem-solving, the inquiry approach has been applied to learning numerous times (Song, Y. 2015). Science basically has two aspects. The first is science, both as a finished good and as a method. Natural science is a group of knowledge which contains facts, concepts, principles, and theories. The products of this group called science. Science, as a systematic endeavour, involves the skills and attitudes necessary for the acquisition and progression of new knowledge.

1. **Hypothesis:**

The mean of the student's achievement scores in the experimental group and controlled group will not differ significantly.

2. **Methodology**

A. Research Design

The experimental design of the study was used. It was decided to use inquiry-based learning method, the random sampling technique was used for homogenous group. The study design consists of two groups due to the presence of the control group and Experimental group (each has 15 students). After illuminating the experimental group was treated with inquiry-based learning method while traditional method was used for control group and the post-test on both groups was administered. The experimental design involving pre- and post-tests has several inherent flaws, including concerns about internal validity related to factors such as maturation, history, instrumentation, regression, and others (Campbell & Stanley, 1963). As shown in Figure 1, there was no significant difference between the two groups, suggesting that the impact of the equipment can be ruled out, and instruction was initiated simultaneously for both groups.

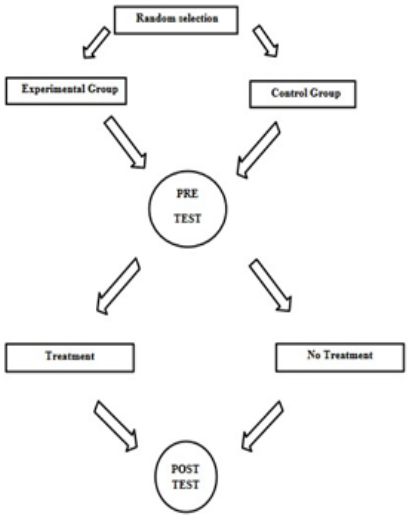

Figure1. Pre &post-test control group design

B. Population:

This study was consisting of the all students with hearing impaired studying in grade VI in special education schools in Sargodha district as a population Students with hearing impairment are taught in the different school setup in Pakistan. The intention to select the grade VI was that they had the initial exposure of reading, and during the initial grade students underwent a rapid cognitive growth through active learning. Their cognitive and physical capabilities are growing enough to gain knowledge and response on new intervention.

C. Sample and Sampling Techniques

The sample consisted of grade VI students enrolled in special education schools of district Sargodha List of the Students were obtained from the class VI. This study was executed in boy school because maximum number of students enrolled are boys, so there was no heterogeneity in terms of gender. Both groups (control and experimental group) were reading in class were divided in two groups. After that systematic sampling technique was used, and every second member from list of scores was included in experimental group.

Table 1: Control group and experimental Group

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

*C stands for Control Group

*E stands for Experimental Group

D. Instrument:

In order to measure the inquiry-based learning method's effectiveness in teaching science and the achievement of students with hearing impairment, it was necessary to develop a self ma test. For this purpose, the researcher visited the schools of special education who are dealing with the students of hearing impairment to discuss the content and syllabus of science which is taught in the classrooms with the related teachers for the purpose of the experiment. So, the test was administered. The researcher was developed test on the basis of literature review under guidance of related teachers and supervisor and content of science for grade VI which is taught in all special education schools and they all are following the book of Punjab text book board with modified syllabus.

E. Validity of instrument:

After development of the test, the test was discussed with the honourable supervisor, and related experts who are dealing the student with hearing impairment; psychologists, speech therapist and teachers. The test was presented to fifteen experts, including nine teachers of the students with hearing impairment, three psychologists and three speech therapists. These specialists were asked to rate each and every item of the test on the following criteria:

1. Relevance
2. Clearance
3. Simplicity
4. Ambiguity

F. Reliability of the Test

The instrument was administered to a sample of 10 students with hearing impairment to find out consistency (reliability) of the test. The pilot test score of Cronbach's alpha was 0.824. Test was finalized for the experiment after the pilot testing. In this study, pre and posttest was conducted to measure the effectiveness of inquiry-based method in teaching science to students with hearing impairment studying in grade VI for this purpose same test was applied.

G. Conduction of Experimentation:

Class teacher of the grade VI, one group (experiment) was treated by inquiry-based learning and other control group through traditional method of teaching. The teacher taught the students in the traditional way following the class routine, time table, and teaching methodology with the use of textbook and white board. After that home work was given to the control group on daily basis. The participates of the experimental group provided the treatment with use of inquiry-based learning method for find the difference of independent variable. 45 minute of class period for each day was specified for both groups. There were four class periods per week and the experimental group got treatment for the five weeks. Lessons was based on inquiry-based learning method by using visual images such as real models, power point presentations, videos, charts were delivered to the experimental group. Students were taught through the 5E inquiry instructional model.

H. Data Collection

After the treatment of five weeks, post-test was administered for the both groups. The scores were recorded separately which were got by students of both groups; to attain the objectives of the study. For this purpose, SPSS was used.

I. Data Analysis

The pre-test's scores were analysis first and then the scores of the post-test were analysed and the performance of the both groups were compared and to find the gain (difference) of achievement in science after the treatment through SPSS. For this purpose, the paired and independent sample t -test was used. Gain scores for each group were calculated comparing the difference in gain scores of both groups (control group & experimental group).

4. Results:

Table 3 indicates the results of pretest before the experiment. As we see control and experimental group has no significant difference between the mean score.

Table 4 indicates the results of posttest after conducting the experiment by teaching experimental group through 5E inquiry-based model and control group through traditional method.

Groups	N	Mean	S.D	T	DF	P
Control group	15	47.07	2.60	-1.44	268	0.160
Experimental group	15	48.60	3.180			

Table 3. Data analysis for pre-test scores of 6th class in science subject

Group	N	Mean	S.D	T	DF	p

Control group	15	67.67	4.577	-2.43	28	0.02
Experimental group	15	71.33	3.599			

Table 4. data analysis for the achievement in general Science for post-test scores of 6th class.

5. Research Findings:

- Average score of the experimental group and control group in pretest varies from 48.60 to 47.07. This indicates the scores of experimental groups and the control group in the pretest has no significant mean difference.
- The mean score of the experimental group and control group in post-test varies from 67.60 to 71.33. This significant mean difference represents the effectiveness of the treatment.
- The goal of this study was to look at the assessment of academic performance by comparing student's results taught in inquiry-based learning setting with the results of student who were taught in traditional method.
- When the comparison among the pre-test and post test scores of experimental groups, it was originating that experimental group performed better in post-test as compared to pretest.
- When pretest & posttest scores of both groups (control & experimental) were compared, it was noticed that posttest performance of experimental group better than control group.
- The comparison of groups (experimental and control) showed that experimental group achieved higher gain scores.
- It revealed that treatment has positive effect. From the results concluded that Inquiry-based approach improved the achievement of science.

3. Conclusion:

It was concluded by findings of this study, it can be said the students who were taught through 5E inquiry-based instructional method achieve higher mean scores than those students who were taught through traditional teaching/learning method. The results between the (pre & post) test of the experimental group is a significant in nature. So, we can say that there is a significant difference between traditional teaching/learning method

6.Recommendations:

following recommendations can be made after briefing the study findings.

1. Tutor should adopt the IBL method for scientific concepts building among the students with hearing
   impairment.
2. The curriculum developing committee and writers should take into attention the textbooks designing and developing for hearing impaired children.
3. Specified training should be practiced to the tutors who teach science to hearing impaired pupils.
4. Resources should be providing to special education schools administration for the betterment of science subjects of hearing-impaired students. and inquiry-based teaching/method

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