EFFECT OF HANDS-ON LEARNING AND ACADEMIC ACHIEVEMENT OF KINESTHETIC LEARNERS IN NUMBER WORK IN PREPRIMARY SCHOOLS IN FAISALABAD DISTRICT OF PUNJAB PROVINCE, PAKISTAN

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Abstract
This study investigate the effect of hands-on learning and academic achievement of kinesthetic learners in number work in preprimary schools in Faisalabad District of Punjab province, Pakistan. To achieve this broad objective, two research questions were developed and answered while two research hypotheses were formulated and tested. The study employed a 2 x 2 quasi-experimental design. The target population of the study constitutes all the preprimary school 2 pupils in public secondary schools in Faisalabad District of Punjab province, Pakistan. Purposive sampling technique was used to select the 100 pupils with kinesthetic learning style and Simple random sampling technique was employed to assign schools into experimental group and control group. The instrument for data collection was Number Work Achievement Test which was face validated by three experts. To determine the reliability of the instrument, Cronbach alpha method was used and a reliability coefficient of 0.78 was obtained. Data for the study was collected with the help of Co-researchers. Data collected was analyzed using mean to answer the research questions and independent t-test to test hypotheses. Presentation and analysis of data were made by the use of tables. The result revealed that kinesthetic learners expose to hands-on learning have a higher mean score than those exposed to conventional method. Also, there is significant difference in mean score of kinesthetic learners taught number work with hands-on learning and kinesthetic learners taught number work with conventional teaching method. It was recommended among others that Pupils should be exposed to hands-on learning strategy since the findings of this study indicate that it has a facilitative effect on their achievement in number work.

Keywords: hands-on learning, academic achievement, kinesthetic, learners

Introduction

Education has become one of the most powerful instruments through which a child acquires knowledge, skills, habits, values and attitudes in modern societies. It is also used for laying the foundation for sustainable growth and development of a nation. This explains why the National Policy stipulates that every Pakistan child has a right to education for the purpose of engendering national development. National development is achieved through preprimary, primary, secondary

and tertiary levels of education. At the preprimary stage, the child is expected to develop the ability to do number work.

Number work is a subject that deals with numbers. Gouba (2018) defines number work as a science of structure, order, and relation that has evolved from counting, measuring and describing the shapes of objects. It deals with logical reasoning and quantitative calculations. Gelfand and Shen (2011) describe number work as the science of quantity which treats whatever can be measured or numbered. The authors further state that it is the science of numbers and their operations, interrelations, combinations, generalizations and abstractions. Pierce (2017) views work as a body of knowledge centered on concepts such as quantity, structure, space, change and the academic discipline that studies them.

Through number work, children develop number work concepts such as the knowledge of sequence and temporal awareness. Children also use number work knowledge to represent, communicate, and solve problems in their environment. Morrison (2017) states that number work enables children to develop knowledge of concepts such as understanding of number and numerical operations as well as knowledge of spatial concepts such as shapes and measurement. Number work is an indispensible tool in human development and is therefore essentially needed for sustaining science and technological development.

Several efforts have been made to enhance the teaching and learning of number work at preprimary school levels. However, evidence abound that pupils' achievement in number work are still discouraging. Studies by Okpara (2014) and Amoo and Efunbanjo (2014) reflect on the pupils' poor achievement in number work and also on the dwindling nature of the teaching and learning of number at the preprimary school level. Kurumeh and Imoko (2018) lamented about the students' poor performance in number at preprimary levels of education.

A number of factors have been associated with pupils' under achievement in number work. These include lack of interest, gender, poor teaching and learning method (Ezeahurukwe, 2010 and Uroko, 2010). Achievement is success obtained in school work by an individual in a particular learning exercise. It includes gaining high scores in school subjects and examination. Academic achievement is that which is accomplished by actual execution of class work in the school setting (Bronsard, 2012). It is typically assessed by the use of teachers' ratings, test, and examinations.

For preprimary school pupils, success in school work is important and it continues all through life. Walsh and Gallasi (2012) maintain that during the preprimary school years, the way children view their academic achievement can have influence on their academic achievement at the higher education level. A related study by Anyanwu (2014) found that pupils' failure in school work causes feelings of inferiority at this stage. Many factors could be responsible for pupils' academic achievement.

Teaching method appears to determine pupils' achievement in every subject. Okoro (2018) blames pupils' poor performance in mathematics on teachers' use of poor teaching methods. The author notes that methods employed in teaching rely more on the use of chalk-board, chorus answer, and over-teaching. According to the author, students' active participation is almost non-existent. Appeh (2019) observes that poor preparation of students due to poor teaching and the dearth of facilities are considered as the main reasons for students' poor performance at public examinations. The inability of pupils to engage actively in the learning process tends to dispose the pupils to constant rote learning. This could lead to poor academic achievement as well as examination malpractice.

Adebayo (2011) reveal that conventional teaching method is deficient in creating permanent and meaningful learning. The researchers maintain that it is more of talk and chalk that emphasize rote learning of science in schools. This has only resulted in regurgitation of facts in pupils' examination. Usman (2013) reveals that the teacher employed to teach mathematics may not be qualified at all, but because there is lack of teachers in the field, the imported teacher will teach his subject haphazardly.

Conventional teaching method is an old-fashioned routine approach of teaching. It is teacher-centred and is without pupils' active participation. In a classroom where the conventional teaching method is used, pupils are viewed as passive receivers of information. Oyedeji (2018) remarks that conventional teaching method which is teacher centred does not actively involve the students in the learning and problem-solving processes as they are predominantly passive. Tamblyn (2013) observes that in most Pakistann classrooms where the conventional teaching method is used, they are more teacher-centred than learner-centred. Emphasis in such classrooms seems to be more on teaching than on learning with less attention to the process of learning or how the pupils learn. This has dwarfed the pupils' creative thinking and manipulation which is necessary in today's workplace. In the same vein, Awolabi (2013) observes that the traditional style of teaching fails in teaching learners to think creatively. Given this scenario, there is need to engage the pupils in creative thinking so as to develop problem-solving skills. This can be achieved by making learners the centre of learning activity in order to take charge of their learning using their hands to do some things or perform activities.

Hands-on-learning is a method of instruction where students are guided to gain knowledge by experience. This means giving the students the opportunity to manipulate the objects they are studying, for instance, plants, insects, rocks, water, magnetic field, scientific instruments,

calculators, rulers, mathematical set, and shapes (Ekwueme, Ekon and Ezenwa-Nebife, 2015). In fact, it is a process of doing mathematics and science where students become active participants in the classroom. Haury and Rillero (2015) posit that hands-on learning approach involves the child in a total learning experience which enhances the child's ability to think critically. It is obvious, therefore, that any teaching strategy that is skilled towards this direction can be seen as an activity-oriented teaching method (Hands-on-approach). Unlike the laboratory works, hands-on activities do not necessarily need some special equipment and special medium. According to Jodl and Eckert (2018), hands-on activities are based on the use of everyday gadgets, simple set-ups or low-cost items that can be found and assembled very easily.

Hands-on-approach has been proposed as a means to increase students' academic achievement and understanding of scientific concepts by manipulating objects which may make abstract knowledge more concrete and clearer. Through hands-on-approach, students are able to engage in real life illustrations and observe the effects of changes in different variables. It offers concrete illustrations of concepts. This method is learner-centred which allows the learner to see, touch and manipulate objects while learning as mathematics are more of seeing and doing than hearing; so also with science that advocates "do it yourself". On the contrary, Ekwueme and Meremikwu (2010) observed in their study that some teachers object to the use of interactive activity-oriented method stating that it is time consuming and do not permit total coverage of the syllabus. Fortunately, the new basic science syllabus' coverage is determined by how much skills/knowledge students' have acquired rather than how much of the syllabus is covered as learner centeredness is highly advocated.

Gender is, therefore, another factor that seems to influence pupils' achievement in number work. Money (2011) views gender as a range of characteristics distinguishing males and females,

particularly in the masculine and feminine attributes assigned to them. Gender has remained an issue in number work and a source of disagreement among researchers. While some studies show evidence of males' superiority over the females in number work (Jeje and Olagoke, 2016), others report that females performed better (Opie, and Enukoha, 2012; Salau, 2012). There are those that show no significant differences in males' and females' achievement in mathematics (Olagunju, 2011; Omiri, 2015). These inconsistencies show the need to employ learning strategies that will arouse the interest of both male and female pupils in number work and thereby possibly enhance their achievement in it too.

Students can be grouped into different styles of learners. One of such group is kinesthetic learners. A kinesthetic learning style requires that you manipulate or touch material to learn. Kinesthetic techniques are used in combination with visual and/or auditory study techniques, producing multi-sensory learning. It also involves movement and action; emphasis on doing, direct involvement, demonstrating, showing etc. Individuals that are kinesthetic learn best with and active "hands-on" approach. These learners favour interaction with the physical world. Most of the time kinesthetic learners have a difficult time staying on target and can become unfocused effortlessly (Omiri, 2015).

Research studies reveal that pupils perform poorly especially in number related subjects like mathematics (Chukwu, 2011 and Nwoye, 2020). The poor performance could be attributed to teachers' use of inadequate method. However, there has been little or no evidence of the effect of hands-on learning on pupils' achievement in number work in Pakistan. The results from foreign studies cannot be generalised across countries to people with different ethnic and educational

background. The researcher is, therefore, motivated to find out whether the use of hands-on learning would enhance kinesthetic pupils' achievement in number work.

Purpose of the study

The main purpose of the study is to investigate the effect of hands-on learning and academic achievement of kinesthetic learners in number work in preprimary schools in Faisalabad District of Punjab province, Pakistan. Specifically, the study investigate:

1. The difference in mean score of kinesthetic learners taught number work with hands-on learning and those taught number work with conventional teaching method.
2. The difference in mean score of male and female kinesthetic learners taught number work using hands-on learning strategy

Research Questions

1. What is the difference in mean score of kinesthetic learners taught number work with hands-on learning and kinesthetic learners taught number work with conventional teaching method?
2. What is the difference in mean scores of male and female kinesthetic learners taught number work using hands-on learning strategy?

Research Hypotheses

1. There is no significance difference in mean score of kinesthetic learners taught number work with hands-on learning and kinesthetic learners taught number work with conventional teaching method.

2. There is no significance difference in mean score of male and female kinesthetic learners taught number work with hands-on learning strategy.

Research Method

This study employed a 2 x 2 quasi-experimental design. This implies that the design included two instructional groups: One experimental groups - Hands-on activities; and the conventional teaching method (control group). The area of the study is Faisalabad District of Punjab province, Pakistan. The target population of the study constitutes all the 313 ECE schools in Faisalabad District of Punjab province, Pakistan. A sample size of 100 pupils were randomly selected from five selected secondary schools was used for the study. Purposive sampling technique was used to select the pupils with kinesthetic learning style and Simple random sampling technique was employed to assign schools into experimental group and control group. Two research instrument was used for the study. A 10 items number work achievement test and a 10 items kinesthetic learners questionnaire. The test instrument was used to collected data on the academic performance while the questionnaire was used to select kinesthetic learners. The test and questionnaire were face validated by three experts. The experts were requested to assess the instrument with regard to the clarity of items, simplicity of vocabulary and relevance of items to the study. Based on the observations of these experts, the research instrument was modified appropriately. To test for reliability of the instrument, the Cronbach Alpha test was done and the alpha value for the scale was found to be 0.78 which shows the instrument were reliable. Prior to the commencement of the experiment, the researcher visited the sampled schools with a letter of introduction, stating identity, and explained the purpose of the study and benefits that could be derived if successfully conducted. The heads of ECE schools introduced the researcher to the

teachers whose classes would be used for the study. The researcher used that opportunity to acquaint with the teachers and liaised with them to identify a convenient time for the programme. The programme was built into the schools' schedule in such a way that it would not disrupt the normal school activities. It was once a week during free periods with each lesson lasting for thirty-five minutes. The entire programme lasted for four weeks. The experimental and control groups were taught number work in their normal class setting. The researcher taught the experimental group while the class that was used as the control group was taught by the regular teacher. Before exposing the pupils to treatment, the researcher administered a questionnaire to all the pupils in the sampled classes so as to identify kinesthetic learners. The test administration was done in an informal way for pupils to see it as one of their normal class assessments. After the treatment, a test was administered to the two groups by the same teachers. The tests were administered during free period of the normal school day. Data collected was analyzed using descriptive statistics of mean to answer research questions and independent t-test to test the hypothesis.

Results

Research Question 1

What is the difference in mean score of kinesthetic learners taught number work with hands-on learning and kinesthetic learners taught number work with conventional teaching method?

Table 1: descriptive statistics of the academic performance of Kinesthetic learners taught using hands-on learning strategy and those taught using the conventional method.

Groups	N	Mean	Standard Deviation
Hands-on learning strategy	48	31.06	2.92
Conventional method	52	18.13	2.11

Table 1 above shows that kinesthetic learners exposed to Hands-on learning strategy had mean score was 31.06 and a standard deviation of 2.92. Kinesthetic learners exposed to the conventional method had mean score of 18.13 with a standard deviation of 2.11. This means that Kinesthetic learners who were exposed to number work with Hands-on learning strategy achieved more than those who were not exposed to number work with it.

Research Question 2

What is the difference in mean scores of male and female kinesthetic learners taught number work using hands on strategy?

Table 2: descriptive statistics of the academic performance of male and female Kinesthetic learners

Groups	N	Mean	Standard Deviation
Female	23	16.78	3.88
Male	25	18.28	2.94

Table 2 above shows that female kinesthetic learners exposed to number work with hands-on learning had mean score of 16.78 and a standard deviation of 3.88. The male kinesthetic learners exposed to number work with hands-on learning had mean score of 18.28 and standard deviation of 2.94. This means that male kinesthetic learners perform slightly higher than the female.

Research Hypothesis 1

There is no significance difference in mean score of kinesthetic learners taught number work with hands-on learning and kinesthetic learners taught number work with conventional teaching method.

Table 3: t-test analysis of the academic performance of Kinesthetic learners taught using hands-on learning strategy and those taught using the conventional method.

Groups	N	Mean	Standard Deviation	t-cal	t-crit.	Df	Level of sig.	Decision
Hands-on learning	48	31.06	2.92					
				12.21	1.96	98	.05	rejected
Conventional method	52	18.13	2.11					

For hypothesis one, table 3 indicated that t-cal is 12.21 while t-crit. is 1.96. Since the t-cal. value is greater than t-crit. value, the null hypothesis was rejected. Therefore, the conclusion was that there is significant difference in mean score of kinesthetic learners taught number work with hands-on learning and kinesthetic learners taught number work with conventional teaching method.

Research Hypothesis 2

There is no significance difference in mean score of male and female kinesthetic learners taught number work using hands-on learning strategy.

Table 4: t-test analysis of the academic performance of male and female kinesthetic learners

Groups	N	Mean	Standard Deviation	t-cal	t-crit.	Df	Level of sig.	Decision

Male	25	18.28	2.94	1.51	1.96	46	.05	accepted
Female	23	16.78	3.88					

For hypothesis 2, table 4 showed that t – cal is 1.51 and t-crit. is 1.96. Since the t-cal. value is less than t-crit. value, the null hypothesis was accepted. This shows that statistically there is no significant difference in the mean score of male kinesthetic learners and female kinesthetic learners taught with hands-on learning strategy. This reveals that there is no significance difference in mean score of kinesthetic learners taught number work with hands-on learning and kinesthetic learners taught number work with conventional teaching method was therefore accepted.

Discussion of Findings

The result of the study in table 1 indicates that the mean score of kinesthetic learners expose to hands-on learning have a higher mean score than those exposed to conventional method. Further analysis in table 3 shows that there is significant difference in mean score of kinesthetic learners taught number work with hands-on learning and kinesthetic learners taught number work with conventional teaching method. This means that hands-on learning strategy has a significant effect on kinesthetic learners in number work. The finding of this study is in line with the findings of some earlier studies on the positive effect of hands-on learning strategy with respect to pupils' achievement. The studies conducted by Mahn and Greenwood (2020), Case, Harris and Graham (2012); Eze (2015) provide credence for the present study. The studies showed that there is a significant difference in the mathematics achievement of pupils in the treatment group that used self-instruction strategies than in the achievement of pupils in the control group. The enhancement in pupils' achievement in number work could be due to the pupils' active

participation when taught with hands-on learning strategy. This could be so in that the pupils spent some time and adequate practice during hands-on learning strategy. The strategy could also have assisted the pupils to be focused and to organize the learning task in a logical manner. Zimmerman (2011) noted that when students are explicitly taught with hands-on learning strategy and are also given ample opportunity to practice, there is the tendency that the academic achievement of the students will improve. Corroborating this, Eze (2015) noted that exposing pupils to hands-on learning strategy leads to superior achievement of those exposed to the strategy. The finding of this study suggests that hands-on learning strategy help pupils to actively participate and be in-charge of the learning process. As pupils are deeply involved in active learning with hands-on learning strategy, they are able to learn the number work problems.

The statistical analyses in Table 2 show that male kinesthetic learners in hands-on learning strategy obtained mean scores slightly higher than their female counterparts. Further analyses in table 4 show that the mean score difference in the two groups was found not significant. This means that gender is not a significant factor in determining kinesthetic learners achievement in number work.

Smith (2014) investigated gender as a factor in problem-solving in the use of grid map to study plant distribution in an abandoned school garden. The result of the analysis indicated no significant difference in the achievement of male and female students. Shayer and Adey (2013) found that there was no significant difference in the achievement of male and female students in problem solving in mathematics, and science. On the contrary Byne and Trigwel (2010) reported that male students were superior over their female counterparts in problem-solving and achievement in chemistry. However, Catsambis (2015) reported that girls performed better than boys in science.

The non-significant difference result of this study was based on the fact that male and female students have capable brains and are equally gifted. The claim of one gender outperforming the other cannot be completely authenticated, neither can superiority be generalized. However, any little gender difference can be attributed to factors such as attitude, teaching method, gender disparity and cultural expectations. Exposing pupils to hands-on learning strategy may have removed the differences that existed between the two genders. This implies that both male and female pupils benefited significantly from the strategy. However, the non-significant difference in number work achievement of male and female Kinesthetic pupils could also be attributed to effective use of hands-on learning strategy which ensured pupils' active participation in the learning process.

Conclusion

One of the important attributes of subjects like number work is solving problems. Consequently, no learners can do without using hand to practice solving problems. The findings of this study served as a bases for making the following conclusions: hands-on learning strategy enhance kinesthetic learners in number work. The results of the study also indicated that both male and female kinesthetic learners could be better problem-solvers if they are exposed to hands-on learning strategy. Therefore, it could be concluded that hands-on learning strategy is a good instructional strategy for teaching number work. Adoption of hands-on learning strategy by the teachers would go along way in improving kinesthetic learners performance in number work.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. Pupils should be exposed to hands-on learning strategy since the findings of this study indicate that it has a facilitative effect on their achievement in number work.
2. Pupils should be exposed to the use of hands-on learning strategy, irrespective of their gender as they all benefited significantly from the strategy instruction.
3. Evidence from the study indicates that the hands-on learning strategy could be taught. The in-service teachers should, therefore, be taught this strategy as they themselves need to be equipped with the most effective ways of teaching their pupils number work.
4. Teacher training institutions should incorporate the strategy in their repertoire of instruction strategies that student teachers should be taught to equip them with relevant teaching skills.
5. Federal and State Ministries of Education, Universal Basic Education Board (UBE), Institutions and Colleges as well as other organised bodies interested in the education of the child should organise conferences, workshops, seminars and enlightenment programmes for teachers on how to use such, effective instruction strategy.
6. Through these conferences, workshops, seminars and enlightenment programmes, teachers should be encouraged to make learning pupil-centred and not teacher-centred.
7. They should ensure that pupils are actively involved in the learning activity by allowing them to take active participation in every learning situation.

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