Effect of Outdoor Education on the Concept Attainment of Science at Elementary Level

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Abstract

The main purpose of conducting this research study was to analyze the effect of outdoor education on the concept attainment at elementary level Science subject. It was hypothesized that outdoor education has a significant positive effect on logical concept attainment of scientific processes in Science at elementary level. The objectives of the study were to explore and investigate the concept attainment of scientific processes in Science and student level of participation in an interactive social experience. The population of the study was 8th grade students of elementary level. The Educators school was conveniently selected and 60 students from 8th grade comprised the sample of the study. Two groups were formed; one was designated as control group awhile the other as experimental. The researchers conducted a pretest before teaching the selected topics. The experimental group was taught using the outdoor education method and they were exposed to a natural environment for practical learning of the selected concepts while control group was taught through the traditional method of teaching. After 12 days of teaching to both the groups, the researchers administered a posttest to both the groups. The t-test was applied on the raw scores of bthe groups which showed that there was a significant positive effect of outdoor education on the student learning. It was observed by the researchers that the students of the experimental group took more interest in the leaning process as compared to the control group. Keeping the results in view, it can be recommended that practical activities and learning through nature can be made an integral part of teaching at elementary level so that students show more interest in learning science.

Keywords: *Outdoor Education, Science Education, Elementary level*

1.1 Introduction

The term Outdoor Education came into being in the early 1940s. Outdoor Education can be carried out in multiple environments that enable the learners to maximize their potential to the full in a wide range of experiences. Within the field of education, outdoor education and

environmental education are separate but still closely related areas of study. A type of contextual learning involves field trips, excursions, journeys and doing field studies. In the United States, during the late nineteenth century, some educators who took their students out of the class to help them learn appropriate thoughts, abilities, attitudes, and values could improve substantially in their education. Outdoor Education is a general term used to embrace different types of activities undertaken by primary and secondary level students in a range of different contexts including outdoor and residential visits; field work; outdoor adventurous activities; outdoor pursuits and "outward bound" activities (Brune, 2002). Outdoor educators use camp settings to meet their academic objectives and to improve students' social development and leisure skills during the regular school year. Because outdoor education activities were usually tangled thoroughly to the school curriculum, the field has modified to early-twenty-first century modifications affecting the broader educational field. Coyle (2010) stated that there are some practices in outdoor education and environmental education in which multiple programs do overlap. Although both the fields are interdisciplinary but one principal difference is that outdoor education can be applied to the discipline that is to be effectively taught and learned outside.

There is a positive effect of outdoor education on society as the main foci of outdoor education is to build stronger bonds and relations between societies by means of personal as well as social development. Relevant to this context, Ward (2012) has rightly said that the society seems to be more fearful every day. Outdoor education, therefore, can be extremely useful. Science is a subject that has commonly been taught through outdoor education; keeping in view the importance and value of outdoor learning in science, the researchers decided to conduct their study in science. This research would identify why there is a need to teach science by the outdoor education method. Students feel difficulty in learning the concepts presented to them theoretically only, especially when it comes to the science subjects. As another option, they can also be taught better through using a rational environment as a piece of concrete evidence. The problems, some of them listed above, illustrate why students face so many problems in learning of science and comprehension of scientific concepts.

Science is a subject that has nothing to deal with the abstract. Majority of the concepts are concrete if taken so in their true sense. Unfortunately, our school systems have adopted a very wrong approach towards the teaching of science that is badly affecting the concept building of the school children. If nature of children is used as a source of information gathering and learning, it can have more long-lasting effect on the students/learners. The present study is based on analyzing the effect of

outdoor education and the acquisition of the scientific processes to help students learn and understand science better at elementary level.

1.1.1 Hypothesis

Outdoor education has a significant and positive effect on logical concept attainment of 'the scientific processes' in science at elementary level.

1.1.2 Null Hypothesis

There is no effect of outdoor education on the concept attainment of 'the scientific processes' in science at elementary level.

1.1.3 Operational Definition of the Outdoor Education

An outdoor education is the education that can be developed into a natural study ground for learners, students and anyone interested in a natural environment of learning. Outdoor education also provides alternatives for all to gain a better knowledge of what natural resources are and to understand and appreciate the interconnectedness of these resources. Outside every school building, there exists a blossoming world of "natural studies" with all types of structures that can do a better job of teaching than video tapes and computers, because children often seem to learn best by "doing."

1.1.4 Concept Attainment of the Scientific Processes

The concept attainment of the scientific processes is a teaching strategy which requires students to use inductive reasoning to figure out a concept. Some such concepts, for example, may be heat and light, rainbow making, reflection, radiation, convection, conduction, acids, bases and pH of water. These are just a few of the examples in which scientific processes are involved that were taught to the students in order to help them build better concepts of what they may have or come across in science. All this was done by teaching through the outdoor education method. The topics were taken from 8^{th} class book of Cambridge University Press. The researchers checked the concept attainment of the topics in the form of post test scores.

1.1.5 Objectives

(a) To find out the level of concept attainment of science by using the outdoor education/teaching methodology
(b) To investigate the effectiveness of hands on activities in learning the scientific concepts
(c) To explore the students' level of participation in an interactive social experience
(d) To examine the students' sense of using natural resources for the learning purposes
(e) To have a comparative effect of the outdoor education and the traditional method on the concept attainment of students

1.2 Theoretical Framework

Friedrich Wilhelm Frobel (1782-1852), influenced by the Swedish preschool system, was also influenced by the well-known philosopher Jean-Jacques Rousseau (1712-1778) for his interest to the nature. He was the first one to recognize childhood as a separate age in life and in his book about the young boy Emile, he shows how a child can learn from nature instead of learning just from the formal bookish knowledge. He states that physical activity is very important in the education of a child. They are curious, he claimed, and this curiosity should be utilized to the fullest. Rousseau preached that education should be more sensory and rational; less literary and linguistic. Rather than learning indirectly from books, children should learn through direct experience. He emphasized that teachers are our feet, our hands and our eyes. Man has lived for centuries in harmony with nature. Such symbiotic relationship with nature has shaped human development until the beginning of the industrial era.

Another philosopher Johann Henrick Pestalozzi (1746-1827) emphasized the use of direct, firsthand experiences and real objects, also. According to him, practical skills such as farming, housekeeping, spinning and weaving should be taught in addition to reading, writing, and arithmetic. He used to use yards for lessons in nature study and geography. Pestalozzi, a follower of Rousseau, urged teachers to take their pupils out of the classroom. His approach was actually based on the certainty that the learner would use these beginning experiences at a later time to direct principles and generalizations on his own. Man's capacity to adjust his relationship with the natural and man-made environment, and to transfer experience gained to practical knowledge, passes through various phases:

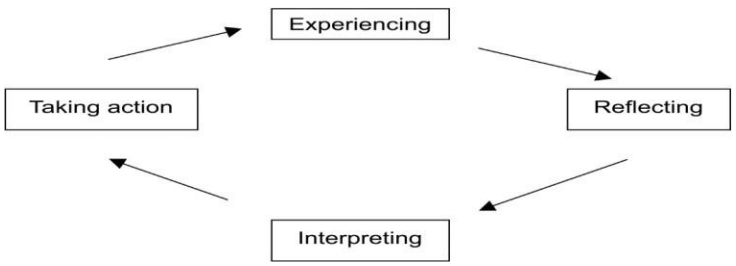

Figure1. Kolb's Theory of Reconstructing of Thought

The experiential learning cycle in the figure focuses on the steps or processes. Initially it begins with experiences. An experience involves the students through direct contribution in an activity. It usually consists of psychomotor domain. The second step of the experience is based on reflecting and the person discusses/thinks upon the encountered experiences. Third step involves interpreting in which the person takes reflection and discussion to another level, while the fourth step involves the

application phase in which the person utilizes the experiential knowledge into his practical life (Bowles, 2004).

1.2.1 Teaching Outdoor Classes

Outdoor entertaining activities are outstanding educational tools for integrating experiential teaching methods and interdisciplinary lesson design because they turn their focus the students' whole self. It involves the three dimensions i.e., physical, mental and emotional. The physical self is based on the movement and activity, the mental self refers to as the questioning and the thinking part and the emotional self includes feelings and connecting the physical with the mental processes (Bunting, 2006).

Outdoor education enhances the academic achievements, for instance, through field work and the physical as well as social development. The school can organize various kinds of educational activities, for instance, a visit to a local community set up in the school playground. Whereas there are many schools which provide a healthy learning friendly environment and organize various kinds of well planned activities which contribute essentially to teaching and learning processes. However, we should not deny the fact that outdoor education may be encompassed with hazardous problems. It may also have problems with some resources and findings (Dietz, 2000). Outdoor education program should be carried out properly and it should be well prepared by the teacher and the teacher should also consider safety and health issues of the students. Due to this and such other reasons, teacher training is the most essential component of the outdoor education system. It is therefore an obvious requirement that the outdoor education programs should be carried out with well qualified people (Meldrum, 2001).

The young minds are stimulated to have a meaningful awareness about the natural environment which connects them with effective knowledge that will enable them to take wise decisions and provide an essential reward for the years of hard effort and training of the outdoor teacher (Hammerman, 2003). Through an effective planning and purposely structuring the learning condition, new generations of children may learn responses, likings and skills connected with the forms of outdoor recreation which need not be the same as those of the initial generations (Ferris, 2007). Galloway (2000) stated that the wilderness programs in education have positive correlations on the retention of first-year students, higher grade point averages, and greater levels of student development than those students who do not participate in such orientation programs. The study relates to a positive idea of providing meaningful learning experiences. A study conducted by Haluza-Delay (2001) inspected the experience of eight teenage participants on a 12-day adventure trip through observation and semi-structured post-trip interviews. The researcher found that the teen participants conceptualized nature as being undisturbed, natural, and

unfamiliar, without people, relaxing and being with a sense of freedom. Although the research was not focusing on meaningful learning experiences, the study indicated that the participants found the experiences more fruitful than their experiences one may have in a traditional classroom setting because there was a sense of no limitations or inhibitions to their levels of self-discovery.

1.2.2 Teaching and Learning Science

The constructivist view of learning contrasts with the behaviorist view of teaching and learning which advocates a passive view of the mind where learners accumulate knowledge provided by the teacher. This view of teaching underlies the traditional approach to teaching. In traditional education, science can look to the learner like a body of knowledge that cannot be challenged, and whose learning leaves little opportunity for a constructive and creative involvement. In constructivist education, the teacher plays the role of a facilitator rather than a transmitter of knowledge. The teacher probes the students' understanding and helps them resolve conflicts between the scientific concepts and their prior knowledge. Constructivism does not advocate that students discover everything for themselves. Rather, constructivist instruction focuses on relating new knowledge both to previously learned knowledge and to experiential phenomena so that students can build a consistent and accurate picture of the physical world.

According to Orion and Hofstein (1994), “science education is conducted predominantly in three types of learning environments: the classroom, the laboratory, and outdoors. The outdoor environment is most neglected by teachers, curriculum developers, and researchers” (p. 1097). Segal et al. (2002) stated that physical activity is important for maintaining social life and increasing the peer relations by catching and meeting up physically. They stated when they are doing activities; if they have no social life it can give them difficult time while doing and coordinating activities. School children with special needs often receive help through public school system and they also focus on their academic skills. He stated that students not only with normal needs need to have social life, but also students with special needs making up social life such that they overcome academic hurdles too. Outdoor classes help students to sort out the problem by coordinating with each other. In 1983, a psychologist Howard Gardner identified different ways that people perceive and understand the world. He categorized these perceptions and abilities as different intelligences. He determined eight different types of intelligences which all relate to the outdoor education in their own perspectives.

Outdoor Education focuses on and utilizes all the eight intelligences presented by Gardner. Gardner determined that intelligence can be defined

as having a set of abilities. These abilities are grouped based on the premise that each individual is mostly different from the other individual/s, each individual has a different way of processing information according to his/her personal experiences and abilities, each individual has a different set of developmental stages and every individual has different historical roots. Knott (2009) has said that science is a practical subject. Science, in essence, is a way of finding things out about the world. Young children are naturally curious about the world and will, if left to their own devices, find out about the world by playing. So science is a playful subject for children. Teachers can exploit this natural tendency and encourage playfulness as a powerful aid to learning. Outdoor classroom setting allows the pupils' time to play with science equipments, as students are the real magicians. Simply providing them the material of any type and letting them make something creative and innovative with them, will ultimately lead them to come up with a miracle. So outdoor education provides major help to the students in science to learn each and every concept clearly and when the base is made strong, the higher concepts become much easier to be understood. Research has specified that the most creative environments for learning, developing motor skills, concentration and learning in general, are unstructured, green and variable. In such studies there was also a decline in children's infections (Scott, 2001).

1.2.3 Research Approach

The study utilized quantitative research approach to determine the effectiveness of teaching of scientific processes through outdoor education in science. According to Gay (1996) quantitative research is a scientific method used for prediction, generalizing a sample results to a larger group of subjects, and using numbers to prove or disprove a hypothesis. For a typical study using quantitative methods, researchers tend to draw a sample of persons at random from a broader population. The present research involved collection of numerical data and the use of statistical analysis to explain data.

The research study employed the experimental research design which falls in the category of true experimental research. According to Shuttleworth (2008) true experimental design is considered as the most exact form of experimental research, in that it tries to prove or disprove a hypothesis mathematically, with a statistical analysis. They employ both a control group and an experimental as a means to measure the change that occurs in both groups. In this sense, an attempt is made to have control of all the confounding variables, or at least consider their impact, while attempting to determine if the treatment is what truly caused the change. The true experiment is often thought of as the only research method that can adequately measure the cause and effect relationship. For teaching

scientific processes to the students of 8th grade, two groups were formed i.e., group 'A' and 'B'. Group 'A' was designated as experimental group while group 'B' was the control group. Pretest and Post tests were used in concluding the results.

Two units were selected from the book of Cambridge University Press of 8th grade for teaching science through the outdoor education in consultation with the experts. The selected units were based on the scientific processes that had enabled the researcher to conduct different experiments for teaching the concepts to the students. The selected topics included:

1. Acids , bases and salts
2. Sources and effects of heat energy

After selecting the units, the following parts were divided in which the components were highlighted that had been addressed in the classroom through the outdoor education methodology:

- Acids
- Bases
- PH of Water
- Convection
- Conduction
- Radiation
- Reflection
- Refraction

1.2.4 Population

The population of the study cconsisted of all the students of 8th grade studying science in the private schools of Rawalpindi.

1.2.5 Sample and Sampling Technique

Sixty students of 8thgrade of The Educators School Chaklala Rawalpindi Branch were taken as the sample of the study through convenient sampling technique. The school was accessible to the researchers. During the meeting with the administration it was asked by the branch head how the students were categorized in different sections. The researchers were told that students were randomly arranged and placed in different sections.

Their age level was the same and the students were divided into two sections randomly. The 60 students belonged to the two different sections, namely, A and B. 30 students were of class 8th A comprising experimental group 'A' and 30 students were of class 8th B which was taken as control group 'B'. As it was a co-education school, so male students in Group A were

17 in number and female students were 13 in number while in group B there were 20 males and 10 female students. The sampling technique was convenient.

1.2.6 Instruments

The study employed pretest and posttest as instruments to evaluate the effect of the outdoor education on the science learners' performance. The instruments were constructed from the two units of eighth grade of science book with the assistance of the supervisor and the subject experts. The items were recvised according to the expert opinion. The pretest and posttest were built on a similar specification; parts from both the units were taken. Each test comprised of 20 multiple choice questions carrying 20 marks and 5 short questions carrying 20 marks i.e., each carrying 4 marks separately. The total marks of both the tests were 40.

1.2.7 Pilot Test and Reliability

In order to check the effectiveness of the instruments, the researchers conducted a pilot test on 15 students, from the same school under study. Keeping the suggestions in view, the items were slightly revised. The test reliability also was administered on fifteen students from the same school. The value of Cronbach's alpha which is acceptable was 0.828. According to Warmbrod (2001), the reliability is considered at acceptable level if it is ranged above 0.8.

1.2.8 Data Analysis

To present data analysis in a brief and concise manner, and to make it more reader friendly so that comprehension is not marred by statistical jargon, the analysis is simplified into three main steps which included:

- Firstly, the mean difference of the pretest and posttest of the control group was analyzed. The mean difference of pre and posttest of experimental group was also analyzed.
- Secondly, the mean differences of the upper and lower achievers were analyzed and then the mean difference of gender was analyzed.
- Thirdly, T-test was applied only on the posttest of control group and posttest of experimental group. According to Heibert (2005) statistical significance is standard, as it detects the smallest valuable effect of the relationship among the variables.

Following are the mean, statistical significance and paired T-test on the pre and posttest of control and experimental group relevant to the study as shown in the tables:

Table 1: Mean Difference of Pre and Posttest of Control Group

	N	Minimum	Maximum	Mean
Pre-test Control	30	6.0	18.0	10.767
Post-test Control	30	6.0	28.0	15.767

There is a significant difference between the mean percentages of both the groups. The mean test score of the pretest of the control group was 10.76 and that of posttest of the control group was 15.76. This shows that the control group has shown a bit of variation on the positive side in their posttest scores, which means that some learning has occurred.

Table 2: Mean Difference of Pretest and Posttest of Experimental Group

	N	Minimum	Maximum	Mean
Pre-test Experimental	30	7.5	23.0	13.717
Post-test Experimental	30	25.0	40.0	35.633

There is a significant increase in the mean of the posttest of the experimental group 35.63 in comparison to that of the pretest of the experimental group 13.71. This shows that the experimental group showed an obvious variation on the positive side in their posttest scores, it means that learning has occurred three times.

Table 3: Mean of Upper and Lower Group of Experimental Group

	Pre-test Score	**Post-test Score**
Upper	$\overline{X}$ =19.60	$\overline{X}$ =30.60
Lower	$\overline{X}$ =9.05	$\overline{X}$ =30.90

Table 4: Mean Differences of Girls and Boys of Experimental Group

Post-test Girls		**Post-test Boys**
$\overline{X}$ =34.92	Total	$\overline{X}$ =36.17

Table 5: Paired Sample T-test

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Post-test Control	15.767	30	4.6493	.8488
	Post-test Experimental	35.633	30	4.1334	.7547

There is a significant increase in the mean of the posttest of the experimental group 35.63 in comparison to that of posttest of the control group 15.71. This shows that the experimental group showed an obvious

variation on the positive side in their posttest scores, it means that learning has occurred three times more than the control group. According to the results analyzed, it can be interpreted that outdoor education provides students with opportunities for learning science concepts better with the help of concrete experiences, allowing self-expression and interaction with people to solve problems.

Paired Samples Test									
		Paired Differences					T	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Post-test Control – Post-test Experimental	-19.8667	6.6500	1.2141	-22.3498	-17.3835	-16.363	29	.000

The calculated value of t= -16.363 which is less than the table value i.e., 1.699 fixing alpha at 0.05 with df=29 (-16.363<1.699<0.05). Hence we reject our null hypothesis and our research hypothesis is accepted which states that outdoor education helps in logical concept attainment of 'the scientific processes' in science at elementary level.

The t-test was applied in the end on the posttest scores of control group and experimental group respectively. The mean differences of both the groups were 35.63 in comparison to that of the posttest of the control group 15.71. This shows that the experimental group has shown an obvious variation on the positive side in their posttest scores. The calculated value of t= -16.363 which is less than the table value i.e., 1.699 fixing alpha at 0.05 with df=29, which rejects the null hypothesis and hence the hypothesis is accepted.

The findings of the study showed that learning through the outdoor education had positive effect on the concept attainment in science subject at 8^{th} grade level.

1.3 Conclusion

The current study was intended to find the effect of outdoor education on the learning of science concepts at elementary level and the results of the tests show that by studying science, through outdoor experiences, students can connect to their local environment and become agents of their community's natural resources. Outdoor education helps students become informed citizens who can add knowledge to the community for a better understanding. It is essential that science teacher

should be aware of the students' needs and teach them appropriate concepts, as science is all about concepts and knowledge, so a teacher should bring together students to an outdoor environment where they can explore ideas relating to individual and group identity. It provides a window for students to view their everyday life from a different vantage-point. Students can demonstrate basic knowledge, skills and attitudes necessary for safe and comfortable outdoor experiences. Schools can build cohesion within the school; create opportunities for meaningful community involvement.

1.4 Recommendations

Keeping in view the results of the study following recommendations are proposed:

i. The culture of rote memorization should be eliminated from school setup through the use of some interesting outdoor activities.

ii. Marks for practicals should be included in every grade so that everyone may get an opportunity to learn practically. Learning through nature may be used as a strategy.

iii. Science and social studies teachers' organizations, can offer interactive workshops for teachers, designed to build familiarity with and confidence in the outdoor learning lessons, activities and teaching methods.

iv. Grounds should be maintained in the schools so that a conducive learning environment may be provided to the students.

v. Practical topics in the curriculum of elementary science should be accompanied by suggested outdoor activities making them a compulsory requirement.

vi. Teacher's guides should be prepared to provide orientation to the school teachers about using outdoor education as an instructional method.

vii. Teachers may be trained to effectively utilize the outdoor education as a resource for science instruction.

viii. Teacher student ratio may be managed, so that teachers can easily conduct the activities with the students.

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