

Exploring effective strategy to improve grade VI-VIII science

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Abstract— The study explored the most effective strategy to improve science in Classes VI-VIII. The researcher selected relevant topics from the science textbooks of classes VI to VIII and taught them using three strategies: demonstration, experimentation and ICT/Video lesson. Paper pencil tests were conducted after completion of each strategy and the mean test scores were compared with the pre-test score. The study employed a mixed mode approach. The data were collected from Classes VI-VIII students (N= 15 from each class) using survey questionnaire and structured interview. The post intervention test score, survey and interview reports revealed that students' interest in learning science is spurred through hands-on experiments.

Keywords— Demonstration, experimentation, strategy, test score, mean.

I. INTRODUCTION

Action research is an important problem-solving tool for the teachers. It can provide opportunities for reflection and improvement - a testing ground for improving the teacher's practice. Teachers use various strategies in teaching science but the students' performance were never up to the satisfaction. Hence an action research was conducted to help improve students' performance in science.

The strategy used for teaching the students is very important in order to enhance their academic performance. It requires teachers to use a variety of teaching strategies to capture students' interest and make them feel motivated so that they can perform well. The present action research was conducted to explore the most effective strategy in teaching science, which will lead to improvement in their performance (Barberos, Gonzalo, & padayogdog). Further, Barberos, Gonzalo, & Padayogdog (n.d) states that teachers need to vary teaching styles and techniques so as not to cause boredom to the students in the classroom.

Among many strategies, the researcher selected three strategies namely 1) Demonstration 2) Experimentation 3) ICT/Video lesson. The researcher taught different topics with different strategies to find out which strategy was the most effective in teaching science.

II. RECONNAISSANCE

The word is derived from French word 'reconnaitre' meaning to look at. Maxwell (2003) said that reconnaissance has three parts: situational analysis, competence of researcher and the researched, and literature review. It is necessary to look at what the researcher is going to do so that an understanding is achieved to ensure a means to move forward. According to Dillon (2008), "Reconnaissance allows investigators to be more aware of where they are at, what they hope to achieve and how they are going to get there" (p.15).

2.1 Situational Analysis

Trashi Yangtse Lower Secondary School was established in 1961 as a pre-primary school. The school was upgraded to a middle secondary school in 1998 and segregated into a lower secondary school after the introduction of Baylling Higher Secondary School. Trashi Yangtse Lower Secondary School is under Yangtse gewog under Trashi Yangtse Dzongkhag (district). The school has an area of 6.10 acres and sport facilities such as football ground, volleyball court, basketball court and multipurpose hall are available. The physical ambience of the school is heightened by the presence of flower gardens and hedges in the school premises. The school has 34 teachers (17 males and 17 females), 10 support staff (4 males and 6 females) and 643 students (326 males and 317 females).

The school is a day school. It has 21 sections with the classes from PP to VIII. Students study science subject from Class IV but the participants chosen for this action research are students of Classes VI, VII and VIII. There are 2 sections of Class VI (20 boys and 29 girls), 3 sections of Class VII with (40 boys and 52 girls) and 2 sections of Class VIII with (31 boys and 41 girls). The school has students from different backgrounds and almost all the dzongkhags (districts). The farthest distance that the students have to walk is about 5 kms. The students' achievement in science till date was not up to the expectation.

2.2 Competence

The researcher had attended action research workshop organized by REC for 5 days and is quite confident to carry out the proposed research. With experiences and knowledge, the researcher assure that the data will be gathered and analyzed authentically

The participants are all well versed with all the 3 strategies used in teaching science and will be able to participate with full attention. They will be instructed in completing the questionnaire and participating in the interview. Therefore, I am confident that participants will be able to give their full participation in this action research and make it a success.

III. LITERATURE REVIEW

3.1 Demonstration

Mutasa & Wills (1995) propounded that the demonstration method involves the teacher showing pupils how to do something while they observe. Pupils' practice will follow the teachers' demonstrations.

According to Chamberlain & Kelly (1981) demonstrations are used to show procedures and to explain techniques. Thus, demonstration is a direct means of explaining things to the pupils.

Demonstration method gives pupils the opportunity to see, hear and become proficient in what is being taught (Iline, 2013). It has been propounded by Chikuni (2003) that, there are two types of demonstrations, namely the step by step and the whole process demonstration. In the whole process demonstration, the teacher demonstrates the full process from the beginning to the end without interruption by learners' participation. The step by step demonstration takes place when the process is in stages that are inter-spaced by learners' participation (Chikuni, 2003).

According to Mckeachie (1986) there is one type of demonstration method known as spot demonstration. In this method, teacher identifies a problem or mistake of a child after the procedure has been shown.

3.2 Experimentation

Lima (n.d) concluded that teaching by experimental method is, in fact, a powerful ally in the task of forming, educating and transmitting contents and attitudes, like those that are present in the Science domains.

As per the Dale's cone of learning, people retain 90% of what they see and do. Experimental activities have been used in science education since the middle of 19th century. Experimental teaching method helps to improve students' hand skills, makes them more productive and increases their active involvement in learning. Students can create a relationship between theory and practice by using experimental teaching method and by applying what they learn into their real life problems through experiments, hence they can make their life more meaningful. Additionally, by using concrete and tangible explanations, students become more involved and absorbed in the lesson (Okan, 1993, as cited in Daru, 2010, pp. 585-587).

According to Dale's (1969) research, the least effective method at the top of cone, involves learning from information presented through verbal symbols, i.e., listening to spoken word-lectures, while the most effective methods at the bottom of cone involves the student active participation in "hands-on" learning activities.

Experimental method has a great importance as it ensures student's active involvement. Observation and learning by doing are the most valid teaching methods (Ivgen, 1997). The method using experimental activities gives the opportunity to develop cognitive skills easily and further it gives a lot of opportunities for the students to work in groups or alone. Further, via this method students are also given opportunity to learn by drill and practice (Algan, 1999). Akdeniz et al. (1998) accept the fact that experimental activities encourage affect reasoning, critical thinking, the understanding of science and also help students to develop the ways of producing knowledge.

Duru (2010) concluded that "*The first and most important of all, since students find the theories and rules that are discovered by using mathematics knowledge in high level on their own by trial and error process, it makes learning more enjoyable, easier and increases their success. Second, because students produce knowledge by themselves, they become more involved in lessons which create a continuous activity and liveliness.*"

3.3 ICT/Video lesson

21st century is a world of technology. People are the techno-natives or the netizens. According to Dale’s cones of experience, people retain 20% of what they see and hear (audio-visual). Shepard & Cooper (1982) and Mayer & Gallini (1990) made the connection between visual clues, the memory process, and the recall of new knowledge. Allam (2006) observed that the creative challenge of using moving images and sound enables students to acquire a range of transferable skills which indeed is engaging and insightful. These include research skills, collaborative working, problem solving, technology, and organisational skills (Bijnens, n.d).

The work of Kearney and colleagues show the benefits of using video to produce authentic learning opportunities for students (Kearney & Campbell 2010; Kearney & Schuck, 2006), and how ‘videos’ encourage academic rigour from an advocacy, research based perspective.

IV. ACTION RESEARCH QUESTION

How can I improve grade VI-VIII student’s learning in science?

V. RESEARCH METHODOLOGY

The study employed both quantitative and qualitative data collection tools.

5.1 Qualitative data

Structured interviews were used to collect the students’ perception on the type of teaching strategy they prefer the most. Thematic analysis was used for data analysis and interpretation. According to Braun & Clark (2006), thematic analysis offers an accessible and theoretically-flexible approach to analyzing qualitative data, thus we have analyzed interview data employing thematic approach. All data from the interviews were transcribed and grouped into different categories. The categories are given specific name (codes) that capture the essence of a concept they contain. Further, the categories are grouped into themes. The themes are used as an outline the interpretations of interview data.

5.2 Quantitative data

Pen-and -paper questionnaires were administered to the students of Classes VI-VIII. Students were asked to choose the appropriate response from the scale of 5 point Likert scale ranging from strongly disagree to strongly agree.

Raw survey data were prepared using Microsoft excel and the same was imported to statistical software IBM SPSS 22 for analysis. The software was employed for generating mean, standard deviation, frequency and construction of graphs and pie charts.

Students from Classes VI-VIII participated in the study. All the participants responded to the questionnaire but only 50% of participants (N=15) with equal mix of male and female from each participated in the interview.

VI. ETHICAL CLEARANCE

Formal approval was sought from the School Research Committee to carry out the action research. The researcher then used the ethical guidelines of the school to obtain consent from the students to participate in the research process. The identity of the student participants have been kept confidential.

VII. ANALYSIS OF DATA

This section provides a discussion of quantitative and qualitative data analysis. Data were analyzed using the statistic software called SPSS.

7.1 Questionnaire

The perceptions on the best strategy was collected through questionnaire. Table 1, 2 and 3 show the best strategy through which students learn better.

Table 1: *I learn better in the class when teacher teach through demonstration*

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Disagree	3	10.3	10.3	10.3
No idea	5	17.2	17.2	27.6
Agree	15	51.7	51.7	79.3
Strongly agree	6	20.7	20.7	100.0
Total	29	100.0	100.0	

Table 2: *I learn better in the class when teacher teach through experimentation*

	Frequency	Percent	Valid Percent	Cumulative Percent
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Valid Disagree	2	6.9	6.9	6.9
No idea	2	6.9	6.9	13.8
Agree	13	44.8	44.8	58.6
Strongly agree	11	37.9	37.9	96.6
Total	29	100.0	100.0	

Table 3: I learn better in the class when teacher teach through ICT/Video

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Disagree	6	20.7	20.7	20.7
No idea	5	17.2	17.2	37.9
Agree	9	31.0	31.0	69.0
Strongly agree	9	31.0	31.0	100.0
Total	29	100.0	100.0	

From the above table, it is evident that 37.9% of the student participants “strongly agreed” that they learn better when they were taught through experimentation. 31% of the total participants believe that they learn better through ICT/video lesson and 20.7 % of the participants learn better when they were taught through demonstration.

Table 4, 5 and 6 show the perception of students about the best method.

Table 4: Demonstration is best method for teaching

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid strongly disagree	1	3.4	3.4	3.4
Disagree	5	17.2	17.2	20.7
no idea	8	27.6	27.6	48.3
Agree	10	34.5	34.5	82.8

strongly agree	5	17.2	17.2	100.0
Total	29	100.0	100.0	

Table 5: Experimentation is best method for teaching

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Disagree	2	6.9	6.9	6.9
no idea	7	24.1	24.1	31.0
Agree	13	44.8	44.8	75.9
strongly agree	7	24.1	24.1	100.0
Total	29	100.0	100.0	

Table 6: Video lesson is the best method for teaching

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Disagree	5	17.2	17.2	17.2
no idea	11	37.9	37.9	55.2
Agree	10	34.5	34.5	89.7
strongly agree	3	10.3	10.3	100.0
Total	29	100.0	100.0	

It is revealed from the above table that 24.1 % of the participant strongly agreed experiment method as a best method followed by 17.2 % and 10.3% for demonstration and ICT/video lesson respectively. There is a high correlation between table 1, 2, 3 and 4, 5 and 6. Thus, experimentation is the best method to enhance students’ learning in science.

7.2 Paper Pencil Test

Paper pencil test were conducted after every strategy to see which method improved students’ learning in science. The

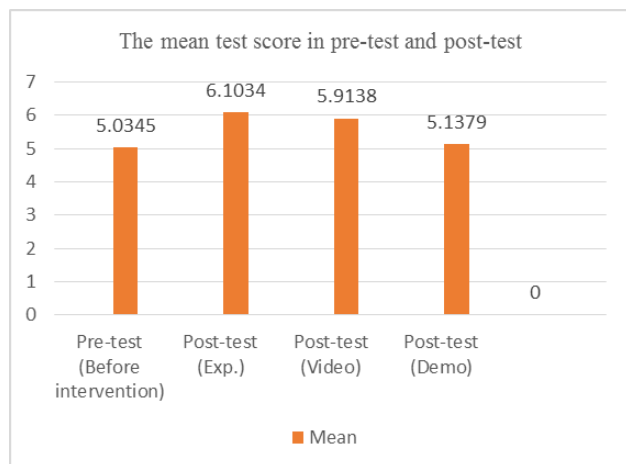
test score of the three strategies: Experimentation, demonstration and ICT/Video lesson were compared through mean test score that students' obtained in pre-test and post-test.

The graph below shows the mean test score before and after intervention.

Descriptive Statistics

	N	Mean	Std. Deviation
Pre-test (Before intervention)	29	5.0345	1.17967
Post-test (Exp.)	29	6.1034	1.68703
Post-test (Video)	29	5.9138	1.32334
Post-test (Demo)	29	5.1379	1.12517
Valid N (list wise)	29		

Graph 1: The mean test score in demonstration, experimentation and video lesson after interventions.



The finding shows an improved trend in the test score when intervention such as experimentation method was used to teach them. Other methods such as demonstration and video lesson could not be the best method yet the difference of marks obtained when teaching using these methods are negligible.

7.3 Interview

The researcher carried out thematic analysis for the interview data from 60 participants. Firstly, each transcript

was read. After that the data were coded. A theme had been framed and excerpts had been included after the subthemes to capture the full meaning of the points in interview data analysis.

Table 1: Demonstration Method

Theme	Subtheme	Excerpts
Effectiveness of the strategy	Can't concentrate	-I can't concentrate well
	Don't understand	- we don't understand much
	Learning	-Doesn't help us in learning -Doesn't enhance our learning like experimentation method
Retention	Remembering	-Can't remember what we learned for long
Mood	Boring	-If teacher is not active we feel boring.
	Uncomfortable	- I feel like it makes more uncomfortable
	Feel unhappy	-I feel unhappy when teacher teaches using this method.

Table 1 shows that the Demonstration method is not effective as the interviewees cannot concentrate on the lesson, cannot understand much and does not enhance their learning. The retention rate of the lesson learned is very short as the interviewees have mentioned that they can't remember what they learned for long. The mood of the students experienced during the lesson is not positive as the interviewees felt bored, uncomfortable and unhappy when they were taught using Demonstration method.

Table 2: Experimentation Method

Theme	Subtheme	Excerpts
Effectiveness of the strategy	Enhance learning	-It enhance my learning because it's something that we do practically
	Understanding	

		-We do practically so we understand clearly
Retention	Memory Remembering	-strengthen our memory -Can remember what we learned for long duration.
Mood	Interesting Happy	-I feel interesting to learn -I feel happy when teacher uses this method

method is ineffective and don't understand the lesson as they can't understand some of the videos since they can't pick up what is said in the videos. The retention rate of the lesson learned is very short as the interviewees have mentioned that they can remember what they learned only for a short duration. The mood of the students experienced during the lesson is not positive as the interviewees feel bored and unhappy when they were taught using ICT/Video Lesson.

The conclusion drawn from the interview data is that the most effective strategy to enhance students' performance in science is Experimentation method as the students can experience "learning by doing."

Table 2 interprets that the Experimentation method was effective as the interviewees expressed that they understood the lesson clearly and their learning was enhanced as they could experience to learn the lessons practically. The retention rate of the lesson learned was good as the interviewees have mentioned that they can remember what they learned for a long duration and strengthen their memory. The mood of the students experienced during the lesson was positive as the interviewees felt interesting and happy when they were taught using experimentation method.

VIII. RESULTS AND DISCUSSION

In this section, the findings are discussed in light of the literature on the topic.

Table 1: Perception of students on different strategy.

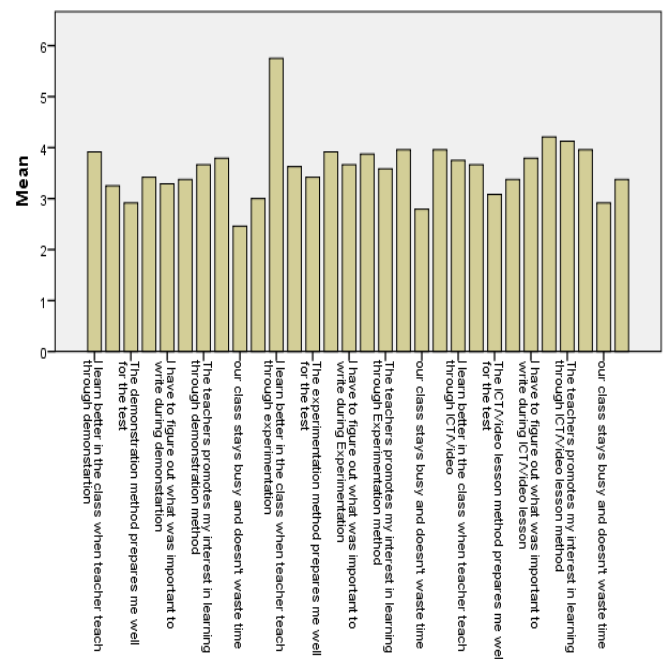


Table 3: ICT/Video Lesson

Theme	Subtheme	Excerpts
Effectiveness of the strategy	Ineffective Understanding	-I feel the method is ineffective -Can't understand the language
Retention	Remembering	-Can remember only for a short duration.
Mood	Bored Unhappy	-I feel bored -I feel unhappy when teacher teaches using this method.

Literature has shown that students' learning has been enhanced when they were taught through hands-on-method. According to Dhanapal & Zi Shan (2014) they indicated that a number of students obtained better results as they learnt and remembered better through hands-on experiments. Further, they found out that there was generally a higher level of participation and intrinsic motivation shown in the students when they learnt through hands-on experiments. This finding is consistent with the finding of the present study which highlights that students

Table 3 interprets that the ICT/Video Lesson is not effective as the interviewees have expressed that the

learn better when they are taught through experiments. 44.8% and 37.9 % of the participants agreed and strongly agreed that they learn better through experimentation. 64.9% of the participants agreed that experimentation is the best method. Interview data revealed that their learning had improved by experimentation method. 90% of the participants had quoted saying “It enhance my learning because it’s something that we do practically.”, “We do practically so we understand clearly”, “strengthen our memory”, “Can remember what we learned for long duration.”, “I feel interesting to learn.” and “I feel happy when teacher uses this method.”

Test score of the students increased when they were taught through experiments. Previous literature had proven that analytical skills of the child was improved by this method (Wahyun & Analita, 2017).

IX. CONCLUSION

This action research was conducted with the aim of finding out the effective strategy to help students to improve their science performance. To sum up this research report, the effectiveness of hands-on experiments towards enhancement of students’ learning process and academic development were shown in various data collected. The majority of the data collected had shown positive results in most of the areas. As a result, this study had proven that hands-on experiments promote students’ learning and builds on their intrinsic motivation. The experimentation method was found to be effective as the students learning was enhanced and by applying what they learn into their real life situations, they can make their life more meaningful.

Based on the findings of the study, it is recommended that further research can be carried out on the implementation of hands-on experiments as there are still gaps in this study.

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10	I get opportunity to speak up and share ideas about the topic.						
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Appendix A (Questionnaires)

Demographic Information

a. Gender: Male Female

b. Class:

1. Demonstration method

Directions: Rate the following statements on a scale of 1-5 (1=Strongly disagree; 2=Disagree, 3=No idea; 4=Agree, 5=Strongly agree) (Please tick the most appropriate answer/rating)

Sl. No	Statement	1	2	3	4	5
1	I learn better in the class when teacher teach through demonstration.					
2	I remember much of what I learn through demonstration method					
3	The demonstration method prepares me very well for test.					
4	The demonstration is the best method for teaching.					
5	I have to figure out what was important to write during demonstration.					
6	I listen attentively when teachers demonstrate.					
7	The teacher promotes my interest in learning through demonstration method.					
8	I like the way we learn in the class.					
9	Our class stays busy and doesn't waste time.					

2. Experimentation method

Directions: Rate the following statements on a scale of 1-5 (1=Strongly disagree; 2=Disagree, 3=No idea; 4=Agree, 5=Strongly agree) (Please tick the most appropriate answer/rating)

Sl. no	Statement	1	2	3	4	5
1	I learn better in the class when teacher teach through experiment.					
2	I remember much of what I learn through experiment.					
3	The experiment prepares me very well for test.					
4	The experimentation method is the best method for teaching.					
5	I have to figure out what was important to write during experiment.					
6	I listen/watch attentively when teacher conduct experiment.					
7	The teacher promotes my interest in learning through experiment.					
8	I like the way we learn in the class.					
9	Our class stays busy and doesn't waste time.					
10	I get opportunity to speak up and share ideas about the topic.					

3. ICT/Video lesson

Directions: Rate the following statements on a scale of 1-5 (1=Strongly disagree; 2=Disagree, 3=No idea; 4=Agree, 5=Strongly agree) (Please tick the most appropriate answer/rating)

Sl. no	Statement	1	2	3	4	5
1	I learn better in the class when teacher teach through ICT/Video lesson.					
2	I remember much of what I learn					

	through ICT/Video lesson.					
3	The ICT/Video lesson prepares me very well for test.					
4	The video lesson is the best method for teaching.					
5	I have to figure out what was important to write during ICT/Video lesson.					
6	I watch/listen attentively during ICT/Video lesson.					
7	The teacher promotes my interest in learning through ICT/Video lesson.					
8	I like the way we learn in the class.					
9	Our class stays busy and doesn't waste time.					
10	I get opportunity to speak up and share ideas about the topic.					

Appendix B (Interview Questions)

A. Demonstration method

1. How do you feel when teacher teach through demonstration method in the classroom?
2. How demonstration method enhance your learning?
3. Write two most important advantages of learning through demonstration method.
4. Suggest any two things teachers can do to make the demonstration method more effective.
5. What are the problems of learning through demonstration method in class?

B. Experimentation method

1. How do you feel when teacher teach through experimentation method in the classroom?
2. How experimentation method enhance your learning?
3. Write two most important advantages of learning through experiment.
4. Suggest any two things teachers can do to make the experimentation method more effective.
5. What are the problems of learning through experiment in class?

C. ICT/Video lesson

1. How do you feel when teacher teach through ICT/Video lesson in the classroom?
2. How ICT/Video lesson enhance your learning?
3. Write two most important advantages of learning through ICT/Video lesson.
4. Suggest any two things teachers can do to make the ICT/Video lesson more effective.
5. What are the problems of learning through ICT/Video lesson in class?

Appendix C (Action Plan)

Month	Weeks	Activities
April 2019	3 rd & 4 th week	AR proposal preparation
May	1 st week	AR proposal presentation to the action research committee
	2 nd week	Ethical Clearance
	3 rd week	Base-line data collection through questionnaire.
	4 th week	Base-line data collection through interview.
June	1 st week	Base-line data collection through test.
	2 nd week	Analysis and interpretation of base-line data collected.
August & September		Intervention of strategies.
October	1 st week	Post data collection through questionnaire.
	2 nd week	Post data collection through interview.
	3 rd week	Post data collection through test.
	4 th week	Post data collection through observation.
November	1 st week	Analysis and interpretation of post data collected.
	2 nd week	Data triangulation
	3 rd week	Compilation of the data
	4 th week	AR report writing