THE USE OF NUMBERED HEADS TOGETHER (NHT) ON THE LEARNING ACHIEVEMENT OF BHUTANESE GRADE SIX STUDENTS IN SCIENCE

BY

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Abstract

This study investigated the effectiveness of Numbered Heads Together Strategy on students' learning achievement and satisfaction of Grade Six Bhutanese students in Science. The study adopted mixed methods approach with a target group of 32 Grade Six students, the only section of Grade Six of the school.

The quantitative data gathered through the Pretest and the Posttest were analyzed using sample paired t-test based on mean, SD and significant value. The analysis of the Pretest and the Posttest scores revealed a significant difference between the Posttest mean ($\bar{x}$ =14.81) and the Pretest mean ($\bar{x}$ =8.56) with the mean difference of 6.25. The significance value was 0.01 which indicated a significant increase in the Posttest scores as compared to those of the Pretest scores, thus indicating the effectiveness of Numbered Heads Together Strategy in enhancing learning achievement of students in Science. The qualitative data gathered through Learning Behavior Observation and Structured Interviews were analyzed within the framework of content analysis. The analysis of qualitative data showed remarkable satisfaction on using Numbered Heads Together Strategy in learning Science. The analysis of both the data revealed positive impact on learning acheivement and learning satisfaction. Hence,the Numbered Heads Together Strategy is highly recommended to teach science and other subjects.

(Total 102 pages)

Keywords: Numbered Heads Together, Learning Achievement, Learning Satisfaction

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ABBREVIATIONS

Abbreviations	Meaning
BCSEA	Bhutan Council For School Examination and Assessment
NHT	Numbered Heads Together
DCRD	Department of Curriculum and Research Division
IOC	Item Objective Congruence
MOE	Ministry of Education
RCSC	Royal Civil Service Commission
REC	Royal Education Council
NAPE	New Approach to Primary Education
CDEO	Chief District Education Officer
CL	Cooperative Learning

CHAPTER 1

INTRODUCTION

This chapter explicates background and rationale of the study, research objectives, research questions, research hypotheses, scope and limitation of the study. It also includes operational definitions and significance of the study.

1.1 BACKGROUND OF THE STUDY

Science has established extreme mechanism to explain the world, to solve problems and to fulfill human needs. All the important systems emerging in the world such as medicinal services and technological facilities are the products of scientific knowledge (Rull, 2014). The processes and ideas of science are of great importance to everybody. Amrita, Das, and Singh (2014) claim that science allows students to connect their ideology to the world and establish new things. Science has shaped and advanced human culture and well-being to greater height with innovation and creativity. It is indeed the fundamental mechanism to discover the hidden top secrets of the universe for the betterment of human existence (Maqbool, Bahadar, & Abdollahi, 2014).

The ideas and ideology generated from science undergoes constant changes. Scientific knowledge is based on facts and the expertise in science education often justify their work through arguments, laws, findings and debates thus making science subject in our daily lives a pertinent and significant in this current world. It is also one of the lovely subjects that helps in building the wonders of the world. Moreover, it is incorporated with lively and enriching activities, which makes class lively and shapes students to fit in the society. It includes hands-on experiments where children are fully accountable for their learning. Indeed, science is compulsory for our survival.

Science subject in schools has played a pivotal role in shaping our society, presence of human existence and advancement in various aspects. It has influenced significantly in each part of life and transformed the world as a whole. The implication of science subject has been continuously impacting the modern world in multi-faceted areas of studies, hence innovations in teaching of science infusing diversified aids and methodologies have been continuously introducing in the education system to enhance students' performance. Research findings and recently embraced curriculum standards continue to help educators to switch the task of learning from educators to the learners (Wright, 2017). In particular, when the learners take responsibility of their learning, it motivates and encourages them for their own academic success.

In Bhutan, especially the science curriculum for primary classes (Grade IV, V and VI) is an integrated science, which consists of an integration of biology, physics and chemistry. The integrated curriculum is however, offered to the students of Grade Four till Grade Eight in Bhutan. For secondary classes, from Grade Nine onwards the science curriculum branches out into three different subjects namely biology, physics and chemistry. In a way, teaching integrated science in primary classes plays a pivotal role as it builds the basic foundation for those three subjects learnt later during their higher education. In addition, science education is placed utmost importance like any other subjects such as language and mathematics. Science is considered one of the major and compulsory subjects in Bhutanese curriculum. However, considering the fact that science education has become the locus in Bhutanese education system, students across the country seemingly perform poor in science subjects.

The focus is now on how students should be taught. Despite the fact considering the enormous importance of the subject, the traditional strategies are still used in majority of the schools for teaching science curriculum. The mode of teaching is widely lecture based rather than student centered, where science has become metaphorically a sleeping pill for learner rather than an antibiotic for them. It is also seen that most of the science experiments were carried out by the teachers, whereby students were seen less involved in scientific explorations, experimentations and presentations. Students merely listen, sit and observe the teaching of science in the classroom. However, teaching

21st learners through transformational practices has become the new precedence of Bhutanese education system to provide them with skills and concepts demanded by their world (Dorji,Tshering, Lhendup, & Wangchuk, 2018).

Bhutan is now gearing towards contemporary education, which aims at enhancement of student's active learning, self-discovery and motivation to learning science at greater dimensions. The report by Samdrup (2016) in the national newspaper, the Kuensel states that current educational practices in the Bhutanese schools are largely revolving around the premise of conventional lecture method. So, as to opposed to the reports of the recent researches, findings from this study can possibly postulate that educational practices in Bhutan has embraced the philosophical foundations of constructivism and experiential learning theory. The nationwide acquaintance on cooperative learning structure and active learning strategy was carried out on the title transformative pedagogy themed on rethinking education in 2016 to make wider shift in instructional strategy for better learning outcome. However, the consistency in implementation of the strategies and skills remain a greatest challenge in the Bhutanese classroom.

Education system today keeps on constantly changing. From the new syllabuses to new instructional strategies to the incorporation of modern gadgets, educationists constantly seek the right mix of pedagogy and tools to best meet the demands of fast changing society and 21st century learners. Consider for a moment the evolution of education from a one-room school house where students wrote on slate boards to the classroom of today with computers and tablets and projectors. Even in Bhutan education system keeps on changing to meet the demands and the needs of the 21st century learners.

According to Ministry of Education (2014), the average test scores in science have ranged between 39.6 and 44.7 in class IV, between 43.7 and 48.4 in class VI, and between 43 and 53.2 in class VIII. This finding clearly indicated that the student process of acquiring knowledge and learning achievement in science is relatively low comparing to other subjects. The performance of science in Bhutan is becoming a growing concern

among the science educationists. It is gaining significance among the science educationists to understand how the learning of science concepts is obtained and held in memory and particularly in recognizing the factors that cause withholding and understanding of science concepts. Considering the significance, as well as from an applied one, as instructors and teachers strive to help learners to comprehend science concepts clearly instead of memorizing the science ideas and statements. Moreover, according to the report presented by (Bhutan Council for School Examination and Assessment [BCSEA], 2018), the number of children who scored more than 80% in science subject in board examination is just 2.58% comparatively low comparing to how children performed in other subjects such as computer application, history and geography.

In line with the problems stated above, this study proposed the Numbered Heads Together Strategy (NHT) as an alternative strategy to enhance learning achievement and learning satisfaction of Grade Six Bhutanese students' in Science. A number of educators were in favor of Numbered Heads Together for its benefits in logical lesson planning and stimulating interaction among the group member. Moreover, NHT approach is designed to create more active responses from the students while teaching (McMillen et al., 2016).

Further, Numbered Heads Together Strategy is profoundly used in teaching a range of content area subjects due to its power to promote discussion and accountability at both individual and as a group (Teacher Vision, n.d.). Findings of previous studies also authenticated the effectiveness of Numbered Heads Together as an instructional strategy that has been found to maximize the effectiveness of classroom instruction by promoting classroom discussion and enhancing learning achievement of students (Haydon, Maheady, & Hunter, 2010; Maheady, Michielli-Pendl, Harper, & Mallette, 2006). Haydon et al. (2010) therefore recommends Numbered Heads Together Strategy as an effective instructional approach for developing social skill and enhancing learning achievement of the students through equal participation. Moreover, it makes them stay focused on improving everyone's understanding because students cannot predict who will respond for the team.

Having significant encouraging outcomes of the previous studies, the researcher is interested to find out the effect of Numbered Heads Together Strategy on Bhutanese Grade Six students' learning achievement and learning satisfaction in science. There are numerous studies on the impact of other Cooperative learning (CL) method on learners' learning achievement and learning satisfaction. Nevertheless, no studies have yet been conducted on the impact of Numbered Heads Together Strategy for the teaching and learning of science in Bhutanese schools. Consequently, this study attempts to bridge the gap with the available information. The outcome of the study would positively empower teachers in implementing the strategies to enhance the learning outcomes in science and make classrooms lively with the benefits of learners being motivated to attend success in learning science.

1.2 RESEARCH OBJECTIVES

1.2.1 To examine Grade Six Bhutanese students' learning achievement in science through using Numbered Heads Together

1.2.2 To explore the learning satisfaction of Grade Six Bhutanese students' on using Numbered Heads Together

1.3 RESEARCH QUESTIONS

1.3.1 Would the use of Numbered Heads Together (NHT) Strategy enhance the learning achievement of Grade Six Bhutanese students in Science?

1.3.2 What was the learning satisfaction of Grade Six Bhutanese students on using Numbered Heads Together in Science?

1.4 RESEARCH HYPOTHESES

1.4.1 There would be an improvement in Grade Six Bhutanese students' learning achievement in Science after employing Numbered Heads Together Strategy.

1.4.2 There would be learning satisfaction of Grade six Bhutanese students' after employing Numbered Heads Together Strategy in Science.

1.5 SCOPE OF THE STUDY

1.5.1 Location of the Study

This study was carried out in one of the primary schools under Trashi Yangtse district, which is located in the eastern part of Bhutan (Appendix I). This research school is located in a rural area. It was established in 1974 as a primary school. As of 2019 academic year, there are classes ranging from pre-primary till grade six, with 160 students and 10 teachers, including the principal. Grade Six students of this school were selected as the research participants.

1.5.2 Population of the Study

The research school has only one class of Grade Six students for 2019 academic year. As a result, the researcher conducted the study with one target group. The target group comprised 32 participates of mixed gender and abilities with the age ranging from 11 to 13 years.

1.5.3 Content of the Study

The researcher conducted two classes a week for a month, which was eight sessions in total. The lessons began from the first week of August and ended in the last

week of August. Four lesson plans were designed to administer Numbered Heads Together Strategy for the target group.

The focus of the lesson was on “Green Plants” from the Grade Six Science textbook. The topic contained 4 sub-topics. The first topic was taught on food for plants. The lesson was taught for the duration of 40 minutes according to the instructional hour mandated to have by Royal Education Council. Lessons were taught using Numbered Heads Together Strategy according to the given schedule below. Moreover, the topic was selected after aligning the work plan of the subject teacher concerned.

Table 1.1 Content of the Study

Lesson Plans	Topics	Time
	Pretest	Week 1
1	Food for Plants	
2	Leaf-The Food Factory	Week 2
3	Transfer of Pollens	Week 3
4	Dispersal and the Germination of the Seed	Week 4
Posttest		

1.5.4 Conceptual Framework of the Study

For this research, the researcher had one independent variable; Numbered Heads Together. The dependent variables were Learning achievement and Learning satisfaction. The Figure 1.1 shows the illustration of the conceptual framework.

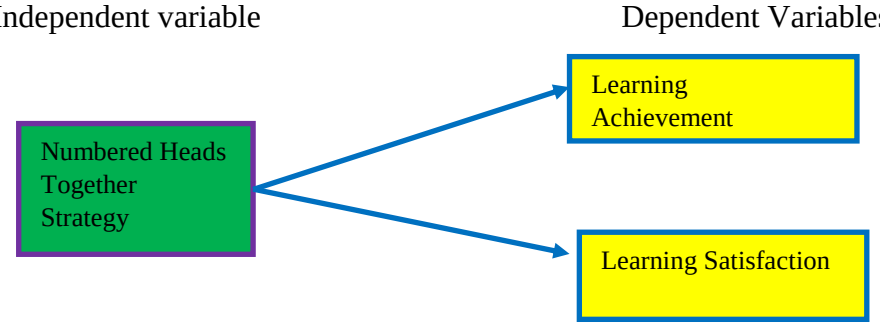

Figure 1.1 Independent and Dependent Variables

1.5.5 Time Frame

The study was carried out in the month of August during the second term of 2019 academic session. The researcher conducted two classes a week and each lesson were planned for the duration of 80 minutes. Nevertheless, the researcher carried out the study in accordance with the timeline framed below.

Table 1.2 Timeline

Activities	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Literature Review												
Research Proposal												
Data collection												
Data Analysis												
Report Writing												
Final Defense												

1.6 LIMITATION OF THE STUDY

The study was undertaken with the only one group of Grade Six Bhutanese students of a primary school located in the eastern Bhutan, so the results and findings corresponding to this study cannot be generalized to all sixth-grade classrooms. Moreover, the sample was limited to only 32 students, which represented a tiny portion of the whole, thus, the findings from this study cannot be generalized to the larger population.

1.7 OPERATIONAL DEFINITIONS

Numbered Heads Together: Numbered Heads Together is an active teaching and learning Strategy in a group of four that makes each one accountable for learning the concepts taught. In this each member of the group is provided with the number and his/her own share of work, but she/he should decide the best and the most appropriate answer of the group by considering each answer. The teacher poses a question and provides think time to think individually for a few seconds. After that, individuals are provided with time to work on their own. After completion of individual work and they are asked to put their heads together to figure out the answers, the teacher calls out a specific number to respond as the spokesperson of the group. By making them work together in a small team, it is certain that each member understands and learns the concept required as no one knows which number will be called, all the team members must work together and be prepared.

Learning Achievement refers to the marks obtained in the Pretest and the Posttest in science by Grade Six Bhutanese students in one of the central schools in the Eastern Bhutan

Grade Six students are the research participants of this study, studying in Grade six at the research school during the academic year 2019.

Science refers to an integrated subject of biology, physics and chemistry that is being taught to Grade Six Bhutanese students. Some of the topics taught are plants, flowers and animals etc.

Satisfaction is students' positive attitude and responses towards using Numbered Heads Together (exhibition of happiness and joy in learning science on using Numbered Heads Together Strategy).

1.8 SIGNIFICANCE OF THE STUDY

1.8.1 The findings of the study may help educationists to better understand the Grade Six attitudes towards learning science on using Numbered Heads Together.

1.8.2 The findings of the study will provide the researcher and the educationists with an insight and knowledge on learning styles of the learners and it would help the learners understand concepts clearly to enhance their learning achievement.

1.8.3 The study might encourage educationists to integrate Numbered Heads Together Strategy in teaching and learning of Science and other content area subject.

CHAPTER 2

LITERATURE REVIEW

This chapter presents the review on the literature related to this study in order to provide theoretical background of the study. It also contains an explicit explanation on Science curriculum in Bhutan, the Numbered Heads Together, the Cooperative learning model and the theories related to the strategy.

2.1 TEACHING OF SCIENCE

The word 'Science' is rooted from the Latin word Scientia, meaning "knowledge". It is a logical activity of assembling ideas and ideology about the natural world and organizing and condensing those ideas into testable laws and theories to innovate and construct the world (Adam, 2015). Bradford (2017) believes that science is a methodical and logical study of how things in the cosmos work and it describes the facts based on observation, experiment and the evidences.

Learning science in the 21st century can be very advantageous to individual of all ages. How we are and the world today are all impact of science around us and the approach you would be able to be acquainted with that happenings and changes that takes on the world would be by venturing into a real education in the field of science. Our world has much advanced. The modern world came into existence only because of science. Many more are yet to be discovered.

The science subject in the primary schools in Bhutan is integrated science, which has the integration of physics, biology and chemistry. Integrated science can be taught in lively ways by incorporating student-centered strategies. Student participation in the learning activities is very important part of teaching and learning

process in this era as they learn much better through active participation than through passive listening to the lecture (DCRD, 2012).

2.2 SCIENCE CURRICULUM OF BHUTAN

The teaching and learning of science in Bhutan formally started with the beginning of modern education in the 1960s.In 1986, the 'New Approach to Primary Education (NAPE) was started, with the main motive to familiarize on the Science curriculum for primary Classes ranging from IV to VI in our own context and to encourage the educationists to teach Science focusing on our country's natural and social surroundings (Department of Curriculum and Research Development [DCRD], 2012).

With changing time, Science curriculum in Bhutan underwent many changes and new Science Curriculum today in Bhutan addresses needs and demands of the 21st century learners. Further, it aids and supports the expansion of scientific literacy across the world in all of its citizens underpinned by the principles of Gross National Happiness (Royal Education Council and Educational Initiatives, 2011).

Science education plays a pivotal role for the developing country like Bhutan and it is very essential in the developmental process. Bhutan, like other developing countries, places great magnitude in institutionalizing a pertinent and challenging science curriculum for all ages of children in the school (Tenzin, 2019).

Formal Integrated Science teaching in Bhutan begins from Grade Four and ends at Grade Eight. From Grade Nine the science subject is further divided into three different subjects namely, biology, physics and chemistry. Science textbooks for Grade Six developed by Royal education council entail chapters which are included under six units in a systematic sequence to enable connection from one content to another. Moreover, it is connected to the upper grade and lower grade. Every topic in the textbook begins with "Test your self-question'' to assess the learners' prior knowledge on the particular topic and to know the background of the learners.

The prescribed objectives have been framed to keep the educationists and the learners directed towards achieving their learning goals at the end of the lesson. Enriching activities are incooperated to attract the learner's attention and to make understanding of each concept practical and easy as intended by the teacher.

Science curriculum in Bhutan was focused on the whole round development of fact-finding skills through activity based and inquiry based learning as opposed to the more traditional methods that focused on the memorization of scientific facts and figures. After a few years of implementation, there was a rising alarm that primary textbooks and manuals for science were deprived of clear contents and teaching and learning techniques that aided learners to grow scientifically. To overcome these problems, learning strategies that could improve students' retention were required. Rusman (2010) states that a learning method that made the students more active, fun, and effective needed to be implemented in order to achieve the learning objectives. One of the learning strategies that can be applied is cooperative learning. Slavin (1995) suggests that a cooperative learning was a learning process in which students worked on assignments together to help one another as a group. The teachers in Numbered Heads Together applied classroom are no longer lecturers dominating the learning activities and carrying out even simple activities by themselves, but more of the students dominating the learning activity.

2.3 COOPERATIVE LEARNING

Numbered Heads Together Strategy is rooted from Cooperative learning strategy and it is one of the widely used strategies amongst known cooperative learning strategies. Cooperative learning as a teaching and learning model involves students working together in small teams jointly to achieve shared goals (Hasmyati & Suwardi, 2018). Kulshrestha and Mehta (2014) defines cooperative learning as a teaching and learning tactic in a small group comprising certain number of students with different abilities with wide backgrounds of the students and varieties of learning activities to make them understand the content.

Cooperative Learning Approach is a contemporary way of teaching used in educational arena to boost the learning process. It plays a vital role in making education favorable and valuable than the traditional learning method. According to Johnson, D., Johnson, R., and Smith (2014), cooperative learning model is an essential tool to meet the challenges and the demands of the 21st century: global interdependency, democratization cooperative, entrepreneurship, and interpersonal relationships. It takes into account of individual learners and make them contribute their ideas in order to expand learning and obtain a common goal for the group (Johnson et al., 2014).

Cooperative Learning has a profound impact on children's learning. It gives learners an opportunity to think critically and work independently. Most importantly, students are at the center of the process. Every part of active learning encourages students to share ideas, act on them, and share the results of their work with others, which inspires everyone in learning.

Harmer (2009) explains that there are some advantages in the teaching learning process in cooperative learning approach (learning in groups). The advantages are as follows:

1) Group work can help the students develop communication skill, leadership skill, and cooperation skill.

2) Group work motivates the students who are bored.

3) Group work allow the students to work and interact independently without necessary guidance of the teacher, thus promoting the student's learning independence.

4) It is comparatively quick and easy to systematize the activities.

5) Group work can improve students' achievement.

2.4 NUMBERED HEADS TOGETHER (NHT) APPROACH

Numbered Heads Together (NHT) is an educational approach rooted from the cooperative learning model, which aims at changing the classroom into a lively setting

whereby children can actively engage in their daily learning activities. According to Sutipnyo and Mosik (2018), NHT learning strategy is one type of cooperative learning model that is intended to enhance students' social interaction and learning outcomes through active participation. Moreover, it serves as a substitute for the traditional classroom structure. It plays an enormous role in changing a passive classroom setting into a lively classroom setting. Numbered Heads Together is not just confined to arranging students into groups, and it has been described as a tool to holistic development of concepts and ideas.

Corebima and Leasa (2017) assert that with NHT we could emphasize each individual's role in a group activities based on the number. Learners can exhibit and showcase their talent and use any tactics to disclose their responsibilities. Every learner in the team is capable in his/her own ways to understand every assigned task comprehensively. Hence, group task is not restricted on one members hard work, but also as a joint task of every individual present in a particular team. This process enhances the learners' ability to tackle with the problems in learning. When the learners are meaningfully engaged in the learning activities, studies have proven that their long-term memory is enhanced (Fandakova & Bunge, 2016; Markant, Ruggeri, Gureckis, & Xu, 2016, as cited in Whiteney 2018).

Teacher Vision (n.d.) states that the Numbered Heads Together (NHT) strategy encourages interaction at individual and group levels. It promotes group accountability and is very useful for revising and teaching content in the class. Learners with various backgrounds benefit from this approach. After the directives on how to carry out an activity from the facilitator, the team members help and support one another and provide a platform to nourish and discuss raw ideas to make it concrete ones. This type of learning approaches encourages students to take ownership of their learning and to learn from friends, as well as from the facilitator.

Park Academy Childcare (2015) states that the key advantage of partaking in a learning activity in a group for students is learning how to become part of a team. Teamwork encourages the use of problem solving technique to achieve to a shared

objective. For example, a group of children working in a science project in any hindrance they will try to help one another for the successful completion of the project. It helps in the development of social skill such as helping, compromising and some of the leadership qualities required for the future. Thus, Numbered Heads Together focuses on a team of four members. Kagan (2017) specifies that developmental rate of social skills and interaction are high in cooperative learning model than in natural surroundings because learners count on their social skills to realize their common goal.

2.4.1 Procedure for Using Numbered Heads Together

Kagan (2017) mentions that Numbered Heads together is a game that guides your class through a series of activities focused to enhance learning through team work, active participation, and individual accountability.

1) Provide Think Time: Every individual in the group thinks how to answer the question. No one is supposed to talk during think time.

2) Write the Answer: Student individually writes their own answer on a paper without referring to others

3) Heads Together: Group members put their heads together and share their responses. They discuss their ideas and come to a common consensus on a team answer

4) Answer the Question: The teacher calls on any number to answer the questions.

2.4.2 Advantages of Using Numbered Heads Together

Numbered Heads Together is one of the active learning strategies that help students to take accountable for their own learning and it promotes class participation with maximum interaction.

The advantages of Numbered Heads Together (NHT) based on five key principles of Kagan's Cooperative learning strategies are as follows:

2.4.2.1 Positive Interdependence

Munafo (2016) defines that positive interdependence is an each individual member in a team learning to relay and cooperate with other teammates. With the use of Numbered Heads Together, children are able to learn from each other and everyone in the team must take equal responsibility to ensure safe and meaningful learning. They must jointly work and help each other to understand and answer the question. Children in the group must know that to have a successful outcome of the group activity it depends on the hard work of each member in the group (Sim & Ananthi, 2017).

2.4.2.2 Individual Accountability

With this technique, every individual member in the team is assessed on what he/she does. The purpose of the learning in groups is to make each individual to take part in the task and share their ideas with friends to better understand the concepts along with the peers and make it stronger as an individual. It ensures that teammates take charge of their shares of the task in the team (Laal, Geranpaye, & Daemi,2013). Members in the team are liable to one another for sharing concepts and ideas, so students are required to master other members' ideas. Every student must be able to give the group response to the question as it is never sure whose number will be called to represent the group. Thus, it encourages active engagement.

2.4.2.3 Equal Participation

Vygotsky (1978) holds that participating in the group makes learners develop social skills and it plays a vital role in socializing the learners. He upholds guided participation, where learners could learn through active participation with team mates or those members who are more experienced compared to themselves. The

learners through participatory interaction with others can socially construct knowledge. This strategy helps each learner within the group and provides equal share of opportunity. It is possible that high achievers might dominate the class discussion and participation but the facilitator must consider and look in to this matter to distribute equal learning opportunities.

2.4.2.4 Simultaneous Interaction

Kagan (2013) defines that simultaneous interaction as the percentage of learners openly interacting and being engaged simultaneously at any one moment. The size of member in the team does not really plays an important role as there is nothing such that team of six is better than four in terms of the amount of participation in the group .In fact, in the equal duration of time in the group of four, each student gets opportunity to discuss and interact almost twice as much as in a group of six.

According to Sim and Ananthi (2017), the face to face interaction among the group members enhances an individual learner's critical and analytical thinking during group work. Learners should be meaningfully engaged in purposeful interaction by letting them understand how to tackle problems, making them grasp new knowledge or connecting present knowledge with prior knowledge. To come up with successful interaction, Facilitators should focus on the group size, let individual learners take full charge of their learning, coach necessary social skills, reinforce and provide rewards to groups. With elevated degrees of interaction at any one moment, all the learners in the groups are meaningfully and actively engaged in a purposeful discussion.

2.4.2.5 Group Processing

The working with teams provides individual members in the team with amply of opportunities to discuss the topics that they are unclear about and what they gain from lessons. Moreover, they can learn new things from peers through experience. They tend to develop required social skills. When students encounter

difficulties in working in groups, it clearly depicts minimum interaction. Thus, they should be made to participate in more group activities to process, identify, define and solve their problems through cooperation.

2.5 NUMBERED HEADS TOGETHER (NHT) APPROACH IN SCIENCE

Education plays a vital role in the development of nation building as it develops the knowledge of the future nation builders, as well as molding their behaviors. Therefore, education should integrate new and contemporary approaches to teaching to befit and meet the demands of the 21st century contemporary learners and the fast changing world. Baloche and Brody (2017) find out that the cooperative learning model has earned its place as an effective pedagogy throughout the world and it is one of the rising pedagogies widely used in classroom teaching. However, it has greatest latent to impact student achievement positively, inspiring learners for learning, promotes team cooperation and intergroup relations, analytical and creative thinking and problem-solving, and a host of other well-researched outcomes.

Science education in schools is not only about the orientation on understanding science but knowing the results and effects in the field of science (Sutipnyo & Mosik, 2018). Science is a lively subject, which encompasses of demonstration, observation, experimentation and investigation. The cooperative learning theory, which is a key guiding force of 21st century education system, recently built the interest of the science experts in terms of designing a curriculum that enables the students to learn through cooperative effort, problem solving, and decision-making.

Pappas (2014) believes that learning does not mean only absorbing what was said or read, but actively involving and seeking for answers and solutions in the learning process. It necessitates vigorous engagement of teachers, learners and environment that surrounds them. Hands on activities, investigating-led learning, group work and enquiry-based learning are essential parts in science education .In an NHT focused classroom, the teacher takes the roles of the facilitator and guide. The

teacher takes the role of the leader, not the controller of the class. Learners positively take accountability of their own learning of the content. They are involved in the activities, ask questions, discuss with their peers to clarify their doubts and help each other in terms of needs. Students could enhance their learning when they are more positive about one another when they learn cooperatively compared to when they learn alone, competitively, or individualistically regardless of the differences in ability, ethnic backgrounds, or being handicapped or not as they get to discuss and exchange ideas with different ability and their peer groups. This promotes the success of all the students.

NHT as learning and teaching strategy comprises various types of group activities focusing on different abilities. Besides, it offers panorama for students to share their thoughts, ideologies and think about the finest response to their learning problems. NHT also aids students in inculcating the skill of in-group presentation so that everyone in the group gets an equal opportunity to display their talent despite their abilities. In a conventional learning, competition among students is inevitable because both high and low ability students attempt to obtain maximal results whereby low ability students are dominated (Corebima & Leasa, 2017).

Learning takes place when the learners are made to take part in the activities actively and the learning materials and processes are interesting for him or her. In pursuing a means to develop academic quality in students in science, Numbered Heads Together (NHT) has been proved effective. Moreover, it is considered an excellent instrument to construct new knowledge about various concepts. If the relationship found in the present study stands true in further investigation, our understanding of Numbered Heads Together (NHT), cooperative learning and development of social skills of students can be improved further.

Similarly, DCRD (2012) states that students learn best, when they are engaged in various types of investigative activities such as formulating questions, designing investigations, carrying out hands on experiments, sharing their findings and conversing their ideas to others in a wide range of ways, encourages learners to feel

and to be creative thinker both in the science classroom as well as in day-to-day activities.In the current period of science and technology, especially, ruled by digital technology the has advanced educational approach to greater place.

The educational philosophies had played a wider role in formulating and shaping the curriculum. Teaching and learning strategy in this reverence has also made a wider shift in accordance with the demands and the needs of current times. The teaching-learning process currently has become greatest topics of rational consideration and of critical query on various fronts, and there have been educational debates among the educational experts on various things such as use of teaching technique, learning materials provided to the learners, various task assigned to various levels throughout the universe. The efficiency of the changes being called for, using student-centered strategy, hands on experiments activities, active engagement pedagogy, are all now well supported by evidence. The relevant data have come from a number of different disciplines that include the learning sciences, cognitive psychology, and educational psychology.

Science today should prepare learners and make sure they meet the demands and are able to cope with any sort of challenges ahead in their life. Scientists and engineers work generally in teams and less often as isolated investigators. Similarly, students should be made to work in groups to gain experiences and learn to share responsibility for learning with their team members.

Current education must ascertain and enable learners to withstand any sort of challenges that they encounter at their daily work places in the future. The teaching strategy should not only serve the academic purpose but also support the holistic development of learners such as in developing social and cooperative skills that are very important in everyday lives. Among all the teaching and learning techniques being applied in the classroom in the world, cooperative learning has its own philosophic and psychosocial significance today. In the perspective of interaction, knowledge sharing, analysis, interpretation, and giving vent to subjective expression in groups, cooperative learning is considered to be of great utility and wisdom, enabling

students to learn with supports from others, motivate and a sense of learning ownership.

2.6 RELATED THEORIES OF TEACHING SCIENCE

The following are various types of learning theories related to Numbered Heads Together Strategy in teaching and learning and its nature of learning in the 21st century education.

2.6.1 Social Learning Theories

Social learning theory is known to the world as learning by observing and imitation. Bandura (1986) claims that an individual acquires behaviors by emulating through observing others. Learning should take place through social interaction or the kind of learning that is involved in determining acceptable sets of behaviors from different situations.

Cherry (2017) states that acquiring new knowledge is a complex process that is governed by a wide variety of aspects. All educationists and most parents are perhaps very much aware of, observation and experiences, playing a fundamental role in determining how individual child acquire new knowledge. Bandura (1986) observes that learning is deeply rooted from social experiences, so observing and interacting with others plays a pivotal role in how one construct new knowledge and skills. Today, both teachers and parents make out how essential it is to model suitable and proper behaviors. Other classroom tactics such as motivating children and building self-esteem are also given utmost importance and rooted in social learning theory.

Generally, In the NHT applied science classroom, children are made to interact and discuss about the concepts and ideas in a team of four. In the process of interaction, children observe and imitate high achievers whereby learning of science facts and concepts in children are enhanced to higher height. Social learning can be enhanced through NHT strategy because interaction is the key element of this strategy.

NHT strategy not only allows students to learn from one another but also stimulates constructive transformation mirrored in enriched behavioral and educational outcomes (Jackson, 2017).

2.6.2 Constructivist Learning

Piaget (1980) states that individual construct new knowledge and derives meaning based upon their experiences that they gain in their daily lives; however, the world views constructivism as a model that takes an account of an active learning process, a knowledge constructive process. The learner is an information creator. They construct or create their own ideas and build new concepts from the experiences that they undergo. Constructivist learning interlinked with the student's prior knowledge (Ultanir, 2012). Constructivism is a profound educational theory, and is particularly pertinent to the daily teaching and learning of science.

Through accommodation and assimilation, learners create new knowledge from their own incidences and experiences (Piaget, 1980). Constructivism figures out learning as a course of action in which learners heartily construct or build innovative ideas and concepts based upon prior knowledge and new information. The teacher remains a guide who reinforces and motivates students to discover and creates knowledge and ideology within the formulated or set framework. It emphasizes the importance of guiding and supporting students to link with prior knowledge and experiences as new information is presented to them so, that they can clarify and dispense with their misunderstanding and build a correct understanding of the topic in a science. Constructivist learning can be encouraged through the use of Numbered Heads Together as it caters for the needs and the involvement of every individual in the process of constructing knowledge from the experiences. When children are taught using NHT strategy, they get ample time to build on their new experiences to understand and clarify their misconceptions with their friends.

2.6.3 Scaffolding Theory

According to Education Reform (2015), scaffolding refers to a process in which teachers provide various support and guidance to the learners to master the skills and concepts to attain learning goals.

Scaffolding is allied with Numbered Heads Together learning strategy because in a Numbered Heads Together applied class, children are the key constructors of the concepts and ideas by taking their own responsibilities, where the teacher just remains as a guide for their activity and provide necessary support when required.

2.6.4 Experiential Learning Theory

Kolb (1984) states that learning is acquiring and understanding of abstract concepts from various sources that can be applicable and flexible in a various range of situations. In Kolb's theory, the driving force for the acquiring of new concepts and ideas are provided by new experiences and incidences. Moreover, Kolb defines learning as a process whereby knowledge and new concepts are built on or is being constructed through the alteration of experiences.

The Numbered Heads Together (NHT) applied classroom is guided by experiential learning theory of Kolb. In this applied classroom, children are made to discuss and work in groups whereby they get enough time to build on their experiences from the social interaction and hands on experiences. Children gain lots of experiences from doing their own work with friends. They get ideas and concepts from the discussion, which remains for a longer duration in their mind.

2.7 RELATED RESEARCH

The following studies conducted to investigate the impact of Numbered Heads Together approach at various levels of education in several subjects indicated that the use of Numbered Heads Together had positive impact on students.

Dieker and Whiteney (2016) conducted a study on title Consultants and Co teachers Affecting Student Outcomes with Numbered Heads Together: Keeping All Engaged. They found out that teaching and learning techniques such as Numbered Heads Together (NHT) boost both intellectual and behavioral outcomes for students with and without disabilities.

Corebima and Leasa (2017) conducted a comparative study, which is conducted in the form of quasi-experimental with pretest-posttest non-equivalent control group design to examine the impact of Numbered Heads Together (NHT) model on primary students' cognitive achievement in natural science. The two learning models were compared. The researcher found out that the cognitive achievement mean score of the students who experienced NHT improved higher than the mean score of the students who experienced the conventional model. Cooperative learning model encourages the students to cooperate in a group so well that creates a meaningful learning process and enhances the students' cognitive achievement.

Wora and Hadisputro (2017) carried out research aiming to enhance the learning activity and achievement of a 10th grade class made up of 30 students in a vocational high school located in the city of Surakarta, Indonesia, on using Numbered Heads Together (NHT) approach. It was found out that, after using NHT approach, the percentage of active students increased in Stage 1 and Stage 2. The result of the test also suggested a similar trend in student achievement. From this, it was concluded that the application of the NHT learning model improves engagement within the learning activity as well as the level of achievement.

S, Nuryanti, and Mustapha (2017) carried out a study, aimed to determine the effect of cooperative learning model Numbered Head Together and Talking Stick to the motivation and learning outcomes of Class Ten students. This research was a pre experimental with the static pretest-posttest group design. The samples of this study were students of ten 'A' as an experimental group 1 with a total of 31 students and the student of Ten 'C' as a class experiment 2 with 32 students. The results of data analysis of student learning motivation questionnaire showed that the experimental

class 1 with the attitude of "agree" was 83.69% and the experimental class 2 with the attitude of "agree was 83.77%. It was concluded that there was the clear influence of cooperative learning model Numbered Head Together towards students' motivation and learning outcomes.

Sutipnyo and Mosik (2018) conducted a study to find out the increasing of students' motivation that has been applied by Numbered Heads Together (NHT) learning model with Science, Environment, Technology, Society (SETS) approach. The study followed quasi-experiment with One Group Pretest-Posttest Design. The data of students' learning motivation gathered through questionnaire and administered before and after NHT learning model with SETS approach. The results indicated that on using NHT learning model with SETS approach could boost the students' learning motivation.

The study carried out by Heriwiyanti, Subroto, and Suprijono (2019) on the titled Implementation of Cooperative Learning Model Numbered Heads Together for Improving Grade four Students Learning Achievement on Social Science aimed to describe the teacher activities, students' activities, and students' achievement. From the findings, it was concluded that the cooperative learning model Numbered Heads Together can improve student achievement in Grade Four.

The research studies discussed above were conducted in different countries with varied grade levels. Interestingly, all the studies were in favor of Numbered Heads Together as an effective strategy, which brings positive effect on students' learning, increased cognitive level of students, significant learning improvement, high level of students' motivation and retention power. Findings of various studies carried out so far clearly hinted that Numbered Heads Together strategy has all the features to be considered as one of the active learning approaches, which will promote learning.

CHAPTER 3

RESEARCH METHODOLOGY

This chapter explains how the study was conducted to get the research question answered and the kind of methodology and instruments used in getting the research questions answered. It also presents the validity and reliability of the instruments. Further, it explains how data collection and analysis was carried out.

3.1 RESEARCH DESIGN

This research used mixed methods approach (qualitative and quantitative) to gather the data. Foodrise Resource Center (n.d.) claims that by carrying out mixed methods, it helps the researcher to get in depth information of the study. Moreover, triangulation allows the researcher to discover aspects of a phenomenon or problems more accurately by collecting data from different sources from a different way. This type of study (Mixed methods) supports and strengthens the findings, aids in knowledge conception, and broadens awareness of the occurrence (McKim, 2017).

This study aimed to find out effects of Numbered Heads Together (NHT) Strategy in teaching Science for Grade Six students to enhance learning achievement and satisfaction. It was designed as a quasi-experimental study. Jaikumar (2018) adds that Quasi-experimental research may be more practicable and applicable because it is not limited with the time and logistical constraints related like other designs. The achievement test consisting of fifteen multiple choice questions and five short answer questions was developed to find out the effects of the Numbered Heads Together Strategy. The Pretest was administered in the first week of the study and the Posttest in the last week to find out the enhancement of learning achievement in Science. The sample group was taught using the Numbered Heads Together Strategy. Furthermore, the researcher also determined the learning satisfaction of students in Science through

use of learning behavior observation sheet and structured interviewing. Figure 3.1 illustrates the research design.

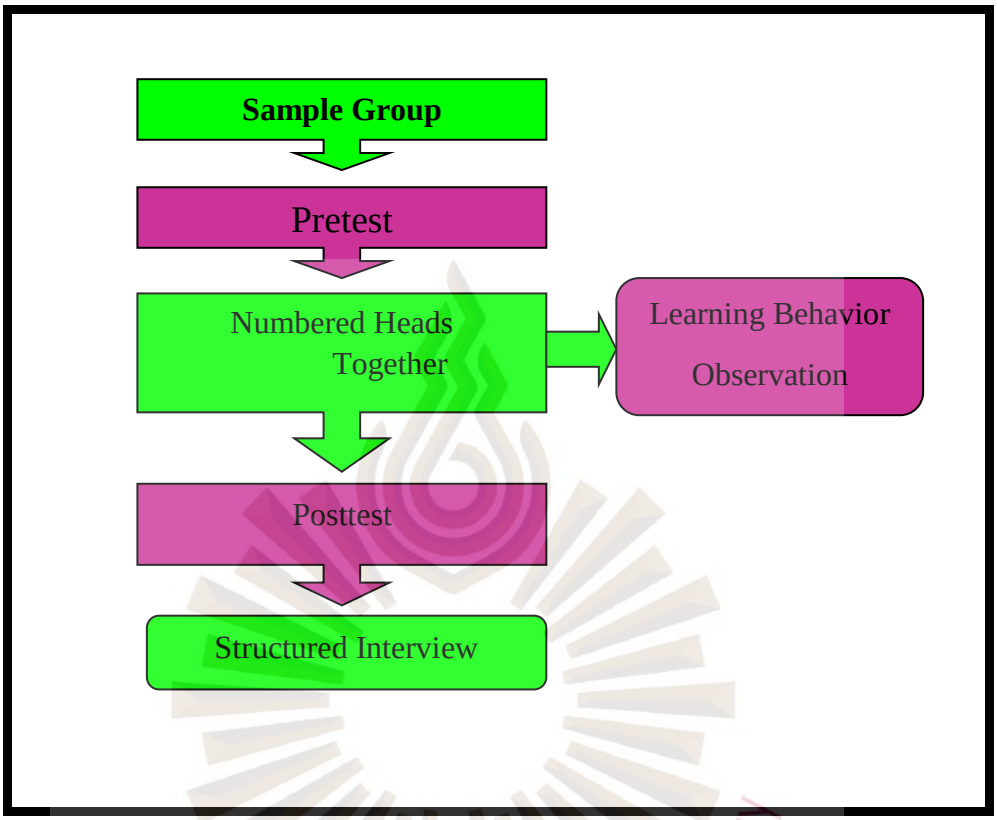

Figure 3.1 Illustrated Research Process

3.2 POPULATION OF THE STUDY

3.2.1 Research Participants

The research school had only one class of Grade Six students for the 2019 Academic Year. The target group comprising 32 Bhutanese Grade Six students was selected for the study.

3.3 RESEARCH INSTRUMENTS

Research instruments are measurement tools planned and prepared to obtain specific and pertinent data on a given research subject. Bastos, Duquia, González-Chica, Mesa, and Bonamigo (2014) states that the selection of instruments that will be used to collect data is a crucial step in the research process as research instruments are materials intended to gather, measure, and analyze information on a topic of interest from research subjects.

Moreover, Jaypath (2014) claims that the compilation and gathering of data is a central part of any research activity. This is because the end products of the study are based on what the data reveals. Hence, no researcher is greater than the data. So, with the aim to obtain authentic and adequate data, this study was administered using quantitative and qualitative research instruments. Figure 3.2 given below represents the relationship between research instruments and data analysis techniques to be adapted based on the research objectives of the study.

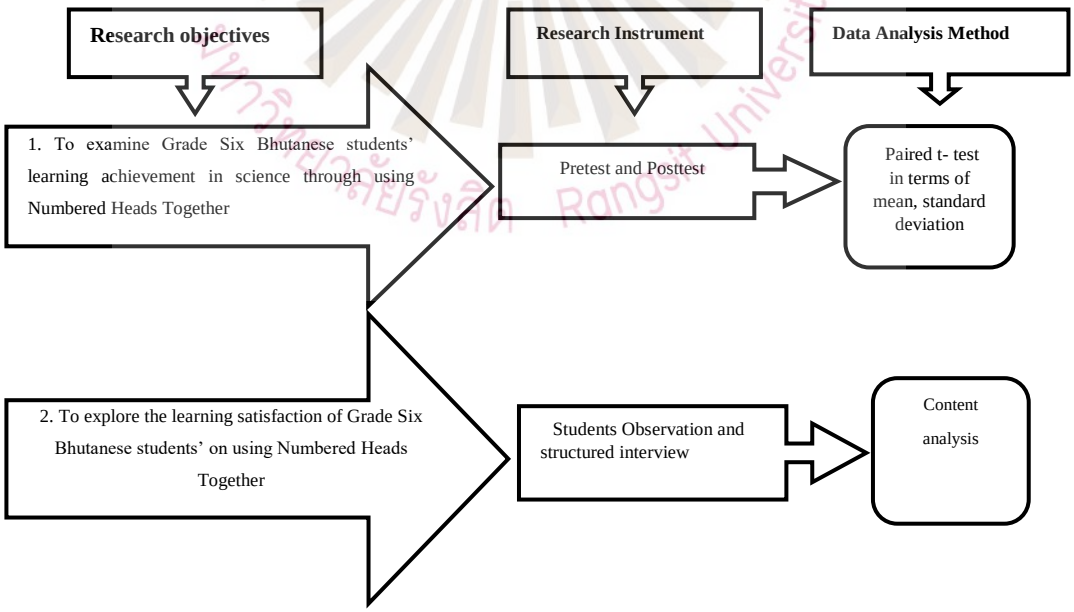

Figure 3.2 Relationships Between Research Objectives, Research Instruments and Data Analysis Method.

3.3.1 Intervention Strategy

3.3.1.1 Lesson Plans

For this study, the researcher designed four lesson plans (Appendix D). One lesson plan was administered for two sessions with the time limit of 40 minutes per session. The target group participants attended two sessions per week to familiarize with the Numbered Heads Together strategy. The researcher ensured that lesson plans prepared mounted for this study contained all the necessary components prescribed in the Science Curriculum Guide book for Grade Six.

3.3.1.2 The Numbered Heads Together Intervention Process

This study employed Numbered Heads Together Strategy as interventional tool to enhance learning achievement and learning satisfaction of the Grade Six Bhutanese Students in Science. The researcher carried out the Pretest at the very beginning of the study before the start of instructional period using Numbered Heads Together Strategy. The first lesson was on food for plants and an introduction to the strategy. Research participants were familiarized on Numbered Heads Together Strategy focusing on the content Food for the plants. They were acquainted to process of Numbered Heads Together Strategy through teaching process. To continue with the lesson, the researcher used Numbered Heads Together Strategy to teach remaining planned topics. The topics were selected from their text book after aligning with the work plan of the subject teacher concerned for the academic year 2019.

3.3.2 Quantitative Data Collection Instruments

3.3.2.1 Pretest and Posttest

To investigate the effectiveness of the Numbered Heads Together Strategy in enhancing student's learning achievement; the researcher administered the

Pretest and the Posttest before and after incorporating Numbered Heads Together Strategy respectively. The learning achievement test was developed based on the learning outcomes as outlined in the Royal Educational Council (REC) curriculum framework (Appendix E). Learning achievement test was prepared by strictly adhering the guidelines of Bhutan Council for School Examination Assessment (BCSEA). Learning achievement test consisted of fifteen multiple-choice questions: each question carried 1 mark and five short answer questions for a total of ten marks which made twenty-five marks in the grand total. The same items were used in the Posttest to mark the consistency of the test after shuffling the items.

3.3.3 Qualitative Data Collection Instruments

3.3.3.1 Behavior Observation

Observation, predominantly participant observation, has been the hallmark of much of the research conducted in anthropological and social science and is a distinctive procedural approach in every field of study. It is the most profoundly used instrument by teacher researchers, counselors and by psychologists whose studies are based on recording human behavior (Kawulich, 2012). Moreover, Anis (2015) claims that observing the behavior of research participants provides the researcher with detailed data for the research. Therefore, this study used students learning behavior observation to get the responses and look at behaviors to get a clear picture of their learning satisfaction towards science on using Numbered Heads Together Strategy.

There are many ways of observation. Of the many ways of observation, the researcher has chosen the structured observation with eight kinds of learning behaviors specified (Appendix F). These learning behaviors were further categorized into two broad themes namely: Students' active participation and individual accountability and interest for learning.

To avoid the bias, the researcher assigned a peer teacher who was a competent Science teacher with 8 years of teaching experience to observe the students while studying in the class. The peer teacher observed three of the eight lessons prepared for the study. The first observation was carried out in the first lesson with the aim to look into their preliminary responses towards learning science on the introduction of Numbered Heads Together Strategy. The second and third observations were carried out in the 5th and 8th lessons respectively with the main aim to find out differences from the first lesson how children participated and took their individual roles in learning. Additionally, the researcher intended to draw a comparison between their initial and final learning behaviors exhibited towards learning science on using Numbered Heads Together Strategy. The collected data was in the format of notes jotted down by the Peer observer under each type of learning behavior.

3.3.3.2 Structured Interviews

According to Indianscribes (2018), structured interview refers to one where the interviewer asks each interviewee the identical set of questions in the exact same order (including probes), in order to assemble constant, consistent and comparable accurate data. Moreover, structured interviews provide data that are reliable, comparable and consistent in nature. Thus, in this study structured interview consisting of three questions was carried out with all 32 students after the posttest with the main rationale of getting the second research question answered (Appendix G). The questions were framed to gather information regarding the students' learning satisfaction in Science through the use of Numbered Heads Together strategy. The researcher coded each of the students' responses with a number to safeguard the privacy of the participants. The following questions were included in the structured interview:

(1) Tell me about learning science through Numbered Heads Together?

(2) How did you feel while learning science through Numbered Heads Together?

(3) What do you like most about Numbered Heads Together strategy?

It was carried out further to support the data collected through behavior observation in mapping out the clear picture of learning satisfaction in learning Science on using Numbered Heads Together Strategy and moreover, to make data authentic and accurate. Further, it was expected that this instrument would bring more information about students learning satisfaction for the Research Objective Two.

3.4 VALIDITY AND RELIABILITY OF THE RESEARCH INSTRUMENTS

3.4.1 Validity

All the research instruments pertaining to this study were validated to lighten the usability issues or to maintain the congruence between the items and the research objectives. Li (2016) claims that by obtaining IOC will ensure that the tool serves the purpose as intended in the study with the population you are studying. For this very purpose, the researcher consulted three experts, one from Rangsit University, Thailand and two senior Bhutanese science teachers from Bhutan. All the instruments were validated based on the Item Objective Congruence (IOC) by Turner and Carlson (2009). IOC result index ranges from -1 to +1. The rating +1 on IOC refers to the accuracy of instruments to the stated objectives, however rating 0 shows that items are good, but not convincing enough to meet the stated objectives. Further, the rating -1 ensures that items are not clearly congruent in meeting the objectives stated.

To ensure their congruence to the stated research objectives, the aforementioned three experts validated the study's instruments. IOC validation was carried out for all the items pertaining to the study. The researcher planned four lessons as the intervention tools. All the four lessons planned, learning behavior observation sheet and interview questions were rated +1 which resulted in the average of 1 for all three instruments which clearly reflected their strong relevancy to the

stated research objectives. Similarly, IOC validations for achievement test items were also carried out by the three experts, which resulted in an average of 0.97 which is relevant to the stated objectives (Appendix H).

3.4.2 Reliability

According to Bolarinwa (2015), reliability is a degree to which a given instruments in the study such as achievement test items, questionnaire, observation checklist or any measurement procedure generates the same outcome on repeated trials. In short, it is the consistency of scores over time. Hobbs (2016) says without the self-assurance that the measure you have selected is reliable, it is difficult to discover whether differences in performance pre and post-intervention are genuinely due to the intervention provided and not an artifact of the tool. In order to determine the reliability coefficient of the learning achievement was done using Cronbha alpha whose coefficient should be equal to or greater than 0.70.

Table 3.2 Description of Internal Consistency using Cronbach's Alpha

Cronbach's Alpha	Internal Consistency
$\alpha \geq 0.9$	Excellent
$0.9\ \alpha \geq 0.8$	Good
$0.8\ \alpha \geq 0.7$	Acceptable
$0.7\ \alpha \geq 0.6$	Questionable
$0.6\ \alpha \geq 0.5$	Poor
$0.5 \geq \alpha$	Unacceptable

Source: Andale, 2014

Learning Achievements test consisting of fifteen multiple choice questions and five short answer questions based on plants was tried out to Grade Six students of another school. The reliability coefficient of the learning achievement test was 0.88 which indicated its relevancy to the stated research objective.

3.5 DATA COLLECTION PROCEDURES

3.5.1 Ethical Consideration

According to Grange, Ramrathan, and Shawa (2017) Ethics are also located within human rights and democracy discourses. With respect to the latter, society has become sensitive to the idea that the rights of people should be protected, particularly those who are vulnerable.

Data collection was commenced only after all the necessary permissions and approvals were received. An approval was sought from Ministry of Education in Bhutan, Chief District Education Officer (CDEO), Principal, and the subject teacher concerned of the research school before the actual data collection has begun (Appendix A). Since research participants are below legal age, all the parents of participants were notified and they agreed to give the consent letters (Appendix J).

3.5.2 Anonymity of the Participants

Data privacy is a crucial aspect that is expected by the participants of every study (Oliver, Wehby, & Reschly, 2011). The anonymity and confidentiality of the participants' responses and learning achievement records were corded through a numbering system. Research participants were numbered instead of using their names to ensure confidentiality.

3.6 DATA ANALYSIS

All statistical analysis was carried out using a computer Program. A comparative statistical analysis was carried out using paired sample t-test for comparing the Pretest and the Posttest scores of the sample group to determine the effect of Numbered Heads Together learning Strategy on learning achievement of students in Science. To find out the impact of Numbered Heads Together Strategy on learning achievement and learning satisfaction of the learners, raw data collected

through students' learning behavior observation and structured interviews were interpreted into responses to the research questions by deriving obvious themes evident in the responses of the participants within the framework of content analysis.

To find out the effects of Numbered Heads Together Strategy on students' learning satisfaction, data gathered through students' learning behavior observation and structured interviews were interpreted into responses to the research question by deriving into obvious themes noticeable in the responses of the participants within the framework of content analysis. The four key phases of content analysis decontextualization (coding System), recontextualization (comparison with the original data), categorization and compilation by (Bengtsson, 2016) had been followed in interpreting the data through behavior observation and structured interviews. The objective of carrying out content analysis is to systematically change a large amount of text into a highly organized and concise summary of key results (Erlingsson & Brysiewicz, 2017).

3.6.1 Pretest and Posttest

The data collected through the Pretest and the Posttest for the duration of four weeks and the comparison of students' learning achievements within the group were analyzed using paired samples t- test. The comparison was carried out based on mean, standard deviation and significant value.

3.6.2 Behaviour Observation

Content analysis was carried out to interpret the data collected through behavior observation.Content analysis is one of the frequent qualitative interpretioning procedures widely and curently used in the world (Schreier,2012). The feedback provided by peer observer were read and reread. Several themes emerged which were catagorised into two major themes.

3.6.3 Structured Interviews

Data gathered through Structured Interviews was analaysed after developing into themes and patterns noticeable from the responses gathered through the interview. The data obtained through structured interviews were used for supporting the information that was gathered through learning behavior observation. Therefore, the data collected in this research were authentic in nature, which provided true data for the study. Besides, interviewed data assisted in strengthening the research findings by making it possible to make it more accurate with reliable inferences.

CHAPTER 4

RESULTS

This chapter presents the results of the research conducted on the effects of Numbered Heads Together Strategy in teaching Science of Grade Six Bhutanese Students. The data was analyzed in two parts. The first set of data analyzed was data gathered through the Pretest and the Posttest which responded to Research Question One. The second set of the data gathered through learning behavior observation and the third set of data gathered through structured interviews was analyzed through content analysis of which the findings were used to respond to Research Question Two.

4.1 ANALYSIS OF THE PRETEST AND THE POSTTEST SCORES

The analysis of the Pretest and the Posttest scores was done to look at the effectiveness of Numbered Heads Together in enhancing students learning in Science. The Pretest and the Posttest comprising 15 multiple choice questions and 5 short answer questions were conducted with 32 Grade Six Bhutanese students before and after the implementation of Numbered Heads Together Strategy. The comparison between the Pretest and the Posttest scores of the sample group was carried out to determine the effectiveness of NHT in Science class.

The first research question of the study was: Would the use of Numbered Heads Together (NHT) Strategy enhance learning achievement of Grade Six students in Science? To acquire the answer for first research question, the Pretest and the Posttest were administered to the sample group. A comparative statistical analysis of the Pretest and the Posttest scores was carried out using paired sample t-test based on mean, standard deviation and significant value.

4.1.1 Pretest- Posttest Comparison

Table 4.1 shows the result of the descriptive statistical analysis for the target group's achievement test scores. The mean score of the Pretest and the Posttest were 8.56 and 14.81 respectively. It is evident from the results presented in Table 4.1 that the Posttest mean score ($\bar{x}$=14.81) of the group was higher than that of the Pretest mean score ($\bar{x}$=8.56) with a mean difference of 6.25. The greater mean score in the Posttest indicated the efficiency of Numbered Heads Together Strategy. This clearly showed the effectiveness on the use of the Numbered Heads Together Strategy. A paired sample t- test shown in Table 4.1 signified the significance value of 0.01 which indicated the significance of the test. The standard deviation of the Pretest and the Posttest were 3.64 and 4.13as shown in the Table 4.1

Table 4.1 Comparison between Pretest and Posttest within the Sample Group

Group	Pretest		Posttest		Mean Difference	T	P – value
Sample Group	$\bar{x}$	SD	$\bar{x}$	SD	14.81 -8.56 = 6.25	- 10.44	0.01
	8.56	3.64	14.81	4.13			

Significance level (p): < 0.05- significant

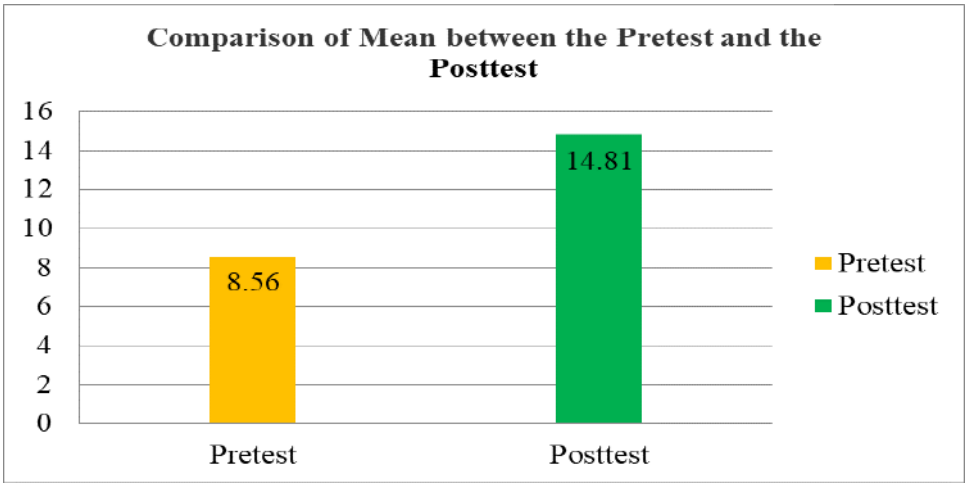

Figure 4.1 Pretest and Posttest Mean Comparison

The scores of the Posttest are comparatively higher than that of the Pretest as shown in figure 4.1. This clearly shows that before using intervention strategy their learning achievement was low compared to the learning achievement after the treatment. All these scores in comparison confirmed the effectiveness of the Numbered Heads Together Strategy in enhancing learning achievement of Bhutanese Grade Six students in science. Thus, providing positive response to the first research question and ascertaining the research objective one and hypothesis one accordingly.

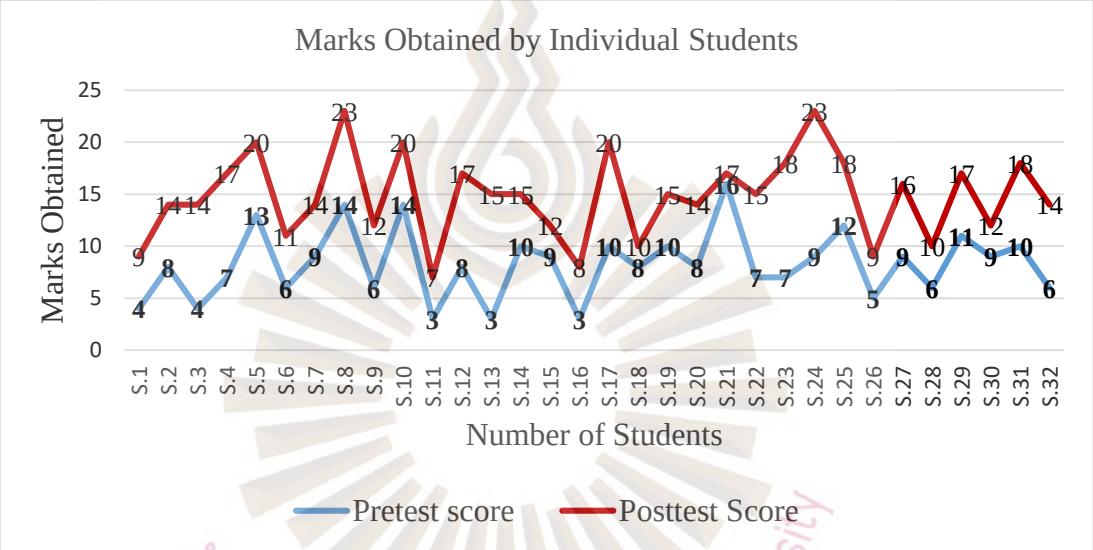

Figure 4.2 Comparative Graphical Representation of Individual Student Learning Achievement Scores in Pretest – Posttest

Figure 4.2, which is represented with the line graph, the blue line denoting the marks scored by individual children in the Pretest and the brown line, which is above the blue line denoting the marks obtained by individual students in the Posttest. The brown line that is above the blue line has a clear indication of individual children performing better in the Posttest comparing to the result of the Pretest. The lowest and the highest scores in the Pretest were 1 and 16 respectively, whereas the lowest and the highest scores in the Posttest were 7 and 23 respectively. All the students scored significantly higher in the Posttest than in the Pretest, and it was concluded that the Numbered Heads Together Strategy plays a vital role in enhancing the learning achievement of science for Grade Six students.

4.2 QUALITATIVE DATA ANALYSIS

The qualitative data gathered through students' learning behavior observation and structured interviews were transcribed and analyzed through the identification of themes and patterns, with the intention to achieve the second research objective and uncover the answers for the second research question: (What was the learning satisfaction of Grade Six students on using Numbered Heads Together in Science?)

4.2.1 Students' Learning Behavior Observation by the Peer Teacher

In order to get the answer for the second research question, the researcher used behavior observation sheet consisting of eight kinds of behaviors. These eight kinds of learning behaviors were further categorized into two broad themes: students' active participation and individual accountability and interest for learning science on using Numbered Heads Together as shown in figure given below. The two themes were framed to draw out students' learning satisfaction on using Numbered Heads Together Strategy in science.

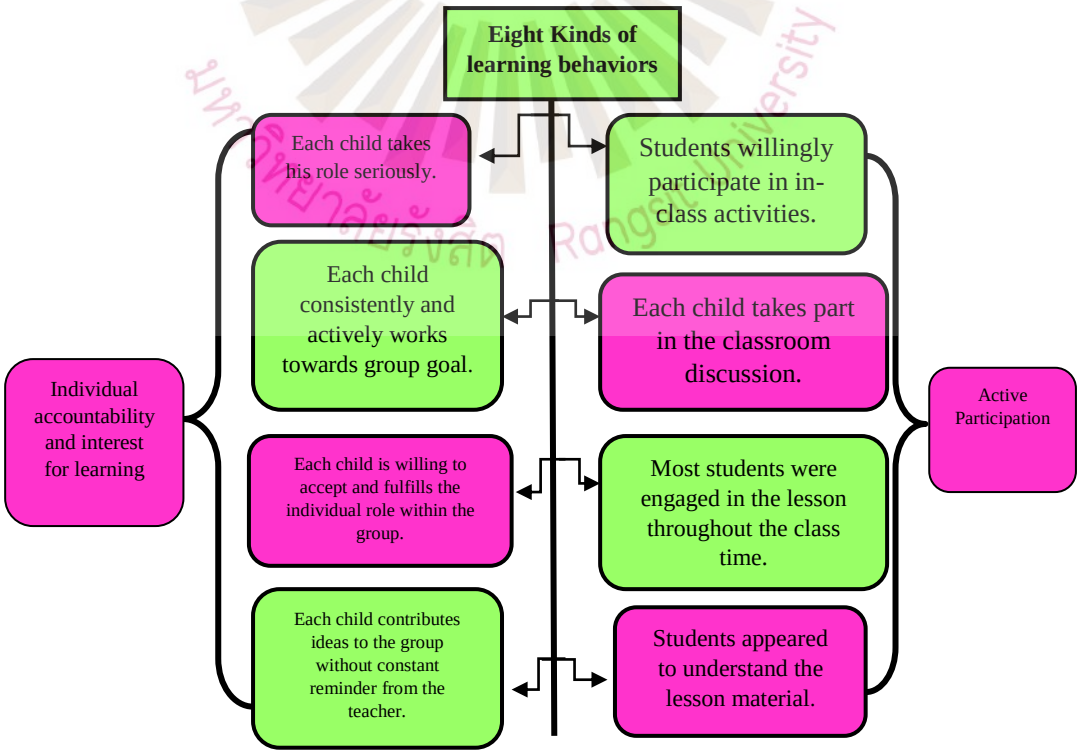

Figure 4.3 Representation of 8 Kinds of Learning Behavior and Two Broad Themes

The Peer observations carried out by the peer teacher were thoroughly read and then analyzed through the identification of themes. The researcher interpreted into two distinct themes from the data gathered through observing students' learning behaviors based on the feedback and comments provided by the peer teacher and based on the eight key areas. The emerged themes were:

1) Active participation
2) Individual accountability and interest for learning

4.2.1.1 Theme 1: Active participation

As mentioned above, the peer teacher observed three lessons, and after looking at the three observation sheets, it clearly depicted that students were engaged fully in the lesson and moreover, students showed an immense interest towards learning Science on using Numbered Heads Together. The peer observer found them all the time attentive and actively participating on the assigned task.

> "There was a strong teamwork amongst the group members. Everyone in the team supported one another in learning and carrying out the assigned task to achieve shared goal."(1st lesson)

It was observed that students were cooperative with their group members and they jointly worked with group members during the pair and group work, which, in turn aided them to accomplish the assigned tasks within the allocated time. The researcher believed that initially, the peer observer sensed some kind of shy expression in students, as he had remarked,

> "I could see some shy facial expressions shown by the individuals in the team while asking for the responses and during the discussions in the beginning; gradually they came forward to participate in the activities in the class and everyone seemed to be enjoying the class." (5th lesson)

This given statement clearly states that with given time and activities, students actively participated in the lesson. Moreover, each child in a group worked towards a common goal. Therefore, in the later part of study, the peer observer saw students taking active part in all the activities. Students' positive and cheerful responses had created a lively learning environment, as the peer observer noticed from the observation.

> "Most of students were very active and responsive to take up assigned task and participate in class activities without having force to participate in the class. Moreover, they were found of no hesitation when they interacted with their peers. They came forward to discuss their views and clarify their ideas with team mates and facilitator" (8th Lesson)

Therefore, learners' active involvement in the activities, taking individual role without constant reminder from the facilitator and display of positive attitudes for learning highly indicated the presence of learning satisfaction in them. According to Sinclaire (2011), learning satisfaction is connected to learners' behavior, learners' willingness to participate actively, positive and their responses towards doing anything.

4.2.1.2 Theme 2: Individual Accountability and Interest for Learning

Every teacher needs to consider all rounds of students in the class. Some are very confident, active and some are shy in the class. This challenge the teachers to make their learners individually accountable for their learning in class. So, with this rationale in mind, based on the observations, Numbered Heads Together Strategy was found to make each child accountable for their learning in the class. In fact, the following observations recorded by the peer observer proved that Numbered Heads Together was the right tool to boost students' learning accountability.

> "On using Numbered Heads Together in science, I can see an enormous difference in taking individual role. Each child in the class takes their role in

the group actively and they could provide responses when ever their number is called for the presentation and sharing their group work. (1st lesson)

Considering the observation, one could easily conclude that with the help of Numbered Heads Together Strategy, students were fully engaged and they were able to take their roles for their learning. Moreover, it was observed that children were encouraged to participate and take their roles in the group for their own learning. The peer observer noticed a drastic improvement in students taking individual accountability for the activities and showed genuine interest for the subject. Everyone in the class remained active without staying idle in the class. Students actively participated and contributed their ideas to the group as mentioned in the given statement below.

"Now each child in the class was willing to accept and fulfills the individual role within the group and was contributing the ideas to the group without constant reminder from the teacher." (5th lesson)

This clearly showed children developed interest for learning when they were engaged in the class activities. Moreover, children learned more when they were actively made to take responsibility in the class instead of teacher adopting teacher centered approach.

4.2.2 Analysis of Structured Interviews

The second research instrument used to gather qualitative data was structured interview consisting of three questions. The interviews were carried out with all 32 students to correlate students' behavior observation in response to the second research question of the study. Moreover, it was carried out as an extension of behavior observation to make data more accurate. The questions for the structured interviews were formulated and framed focusing mainly on uncovering students' learning satisfaction, and most importantly, these questions had been selected after being validated and accepted by the three experts.

The data gathered were transcribed and analyzed through the identification of themes. After in-depth thinking and focus on the responses provided by the participants, the researcher developed into following statements for further interpretation from the collected data from structured interviews:

1) NHT promoted classroom participation and interest for learning

2) NHT facilitated learning satisfaction and clear understanding of concept.

3) NHT promoted individual accountability

4.2.2.1 NHT promoted classroom participation and interest for learning

Students in the class seemed to have enjoyed the classes that have been taught using Numbered Heads Together Strategy. Learning with their teammates made learning fun that promoted classroom participation. With all activities in the group made them engaged without diverting their attention. They felt like playing games in the class as it was clearly stated in the given following statements:

> "I enjoyed learning Science through Numbered Heads Together Strategy because it provided opportunity to help, get help and interact with our teammates and moreover sharing ideas with friends made me learn more." (S.3)

> "I enjoyed learning through Numbered Heads Together Strategy as it made our class very interactive" (S.16).

> "I felt very interested to participate when we are made to discuss in the class." (S.18)

Everyone in the class actively participated in class activity, they cooperated with their friends and everyone was taking a role for the assigned task without having to remind. Learners found out Numbered Heads Together Strategy engages learners actively and arouse their curiosity for learning by providing every

child to show case their talents irrespective of their abilities as it was clearly stated in following given points:

"I felt it is very engaging and interesting to learn science." (S.13)

"It was really fun as we are made to share our views." (S.19)

Students expressed that learning through Numbered Heads Together Strategy activates them as it provides platform to share their thoughts and listen to others' view which makes lesson lively and enjoyable. Moreover, they get to learn social skills to communicate their problems from the content with their friends. Discussion within the group served as a powerful tool for generating authentic ideas comparing to individual work. It helped them to build confidence for learning and it assisted in clarifying their doubts which strengthened their own learning. Everyone felt that their presence was valued. Everyone seemed happy when their views were respected as they felt their importance in the team which helped the promotion of greater participation and interest towards learning. It was clearly revealed from the given statement:

"Sharing and hearing from different individual was enjoyable. It made me active. I learned to discuss my problems with my team mates" (S.8).

"I enjoyed because it helps in building confidence and moreover our opinions are respected" (S.11).

4.2.2.2 NHT facilitated learning satisfaction and clear understanding of concepts

Views, and experiences shared by students during the structured interview clearly exhibited the sense of satisfaction and clear understanding of concepts by the students. Students shared the greater level of satisfaction and better understanding of concepts in science on using Numbered Heads Together Strategy.

Numbered heads Together Strategy helped them learn abstract science concepts better through joint activities in the team and it created lively classroom setting for discussion. Thus, helping them to comprehend the concepts clearly through peer discussion. It maximizes social interaction, love for learning if the learning strategy matches the learners like and interest. When things turn out way one likes everyone seems to pay attention, thus helping students to participate actively and comprehend the concepts clearly with full satisfaction, as it was clearly apparent from the given statement:

"I felt sharing ideas and discussion made me learn more." (S.15)

"It helps to understand the concept better through sharing our views." (S.18)

"I could get to know what is unknown." (S.1)

4.2.2.3 NHT promoted individual accountability

They were fully engaged in the class and it builds conducive learning environment where everyone gets their share of task and opportunity to voice out their ideas. When children are given equal opportunities, they feel their presence is appreciated in which further motivates them to take up and share ideas with friends. This widens their way to learning and understanding the concepts with great sense of satisfaction.

"I liked the lesson because everyone was treated same and provided with equal opportunity." (S.30)

"Self-directed learning and Valuing each other's ideas in group promoted active participation and helped us understand the abstract ideas" (S.18)

"Our ideas are taken care along with our team mates." (S.29).

Research has proven that children learn more when they are asked to do their work by themselves. Moreover, when children are provided with hands-on experiment activities, the learning takes place with greater height for the longer duration. Fostering positive interdependence among groups of students and individual accountability within each student, the Numbered Heads Together Strategy, was a more effective learning tool for all performing students and it just proved as an effective for the majority of other students in comparison to learning science individually.

Students' responses indicated NHT was helpful and made learning Science more engaging and enjoyable, when children are made accountable for her or his performance and learning achievement. They try to become more attentive in the class as they need to complete their share of task in the group. Children learn more when they are directly engaged themselves in learning activities and it retains in our brain for longer duration. When the performance of each individual is assessed, it supports active learning.

The above-mentioned findings suggested that the use of Numbered Heads Together as teaching and learning strategy helped students in scoring higher marks during achievement tests. The use of Numbered Heads Together Strategy facilitated team learning through active participation and an individual accountability. Besides achieving higher scores in the Posttest, Numbered Heads Together strategy also helped in building self-confidence, developing social skills and boosting their interest for learning with remarkable satisfaction.

CHAPTER 5

CONCLUSIONS, DISCUSSIONS, AND RECOMMENDATIONS

This chapter presents clear discussion on the results and findings derived from the quantitative and qualitative data gathered through the achievement test, students' learning observation and structured interviews to confirm the fulfillment of the guiding research objectives and questions. Furthermore, recommendations for practice and future research have also being mentioned towards the end of the chapter. The three major parts of the chapter are conclusion, discussion and recommendation.

5.1 CONCLUSION

This study aimed to observe whether using Numbered Heads Together Strategy enhanced the learning achievement of the Grade Six Bhutanese students and what level of learning satisfaction they had in science on using Numbered Heads Together Strategy. Therefore, the researcher administered the Pretest and the Posttest to find the effectiveness of the strategy in use. To see the level of satisfaction in learning, peer observer observed lesson for three times during the course of the study and structured interview were conducted to gather the data.

5.1.1 Research Question 1

Would the Use of Numbered Heads Together (NHT) Strategy Enhance Learning Achievement of Grade Six Students in Science?

The first overarching objective of the study was to examine Grade Six students' learning achievement in Science on using Numbered Heads Together Strategy. The efficiency of using Numbered Heads Together Strategy was apparent from the findings and analysis of quantitative data collected through the Pretest and the Posttest scores.

Prior to execution of NHT strategy, a Pretest consisting of fifteen multiple choice questions and five short answer questions were administered based on the content to be taught. The same sets of question after shuffling the numbers was used during the Posttest after teaching science on using Numbered Heads Together Strategy. The scores of both the Pretest and the Posttest were recorded and analyzed using a computer program. Upon the comparative statistical analysis using paired sample t-test, it was found out that the mean score of the Pretest and the Posttest were 8.56 and 14.81 respectively with the mean difference of 6.25. The significance value of 0 .01 indicated significant increase in the scores of the students in the Posttest as shown in Figure 4.1 and table 4.1. Moreover, all the students' scores were improved in the Posttest compared to those of the Pretest.

It clearly depicted that using Numbered Heads Together Strategy enhanced learning achievement of the students in science. Thus, it was an indication that Numbered Heads Together Strategy had a significant effect on Bhutanese Grade Six students' achievement in Science. Consequently, the first research question and the first hypothesis (H1) which specified that there would be an improvement in students' learning achievement in Science on using Numbered Heads Together Strategy have been confirmed.

5.1.2 Research Question 2

What Was the Learning Satisfaction of Grade Six Bhutanese students' on using Numbered Heads Together in Science?

The levels of contentment or discontentment had a strong impact on the students' achievement in learning. The remarkable satisfaction in students depicted their motivation, attitude and enthusiasm in learning certain contents. At the same time, it urged them to move further which usually brought positive improvement and higher learning achievement. In this regard, the second guiding objective of this study was to identify Grade Six students' learning satisfaction on using Numbered Heads Together Strategy. For this very purpose, the researcher incorporated students' learning behavior

observation and structured interview to gather qualitative data to support the second research objective and most importantly, to elicit answers for the Research Question Two.

5.1.2.1 Students' learning behavior observation

Students' learning behaviors was observed thrice during the course of the study by the peer teacher. After analyzing all the observations made by the peer teacher, the researcher concluded on the following minor findings:

(1) The peer teacher observed a gradual improvement in students' participation and hence in the later part of the study, all the students were seen active, attentive and engaging in all the activities.

(2) The peer teacher noticed the students' facial expression revealing learning enjoyment and moreover, children were willing to accept the task in the group. Everyone in the group was active irrespective of difference in abilities.

(3) The peer observer noticed that everyone in the class were willing to share their ideas even the ones who hardly spoke in the class started to contribute their ideas later class.

5.1.2.2 Structured Interviews

Structured Interviews were carried out and all 32 students were interviewed individually after the Posttest. The data gathered through Structured Interviews were transcribed, interpreted and analyzed using thematic approach to content analysis and eventually, the researcher arrived to this conclusion that students exhibited an immense satisfaction on using Numbered Heads Together strategy. Students' learning satisfaction was clearly visible as shown in the following analyzed data from the structured interviews.

(1) All the students claimed that with the help of Numbered Heads Together strategy, they were able to grasp and understand the concepts clearly which resulted in securing high achievement scores in the Posttest.

(2) All the children felt interested during the course of the lesson as everyone was fully engaged in the lesson. Everyone took great interest in learning. They explained that Numbered Heads Together Strategy made them feel like playing games in the group and moreover, sharing ideas with friends made them clear with abstract concepts.

(3) Self-directed Learning played an important role in comparing to learning through lectures. Moreover, learning through activities and carrying activities themselves retained in their memory for longer duration comparing to learning taking place with the lecture method. They could understand the topics clearly when they were made to work by themselves rather than teacher carrying out the activity.

5.2 DISCUSSION

The findings of this study were:

1) Numbered Heads Together Strategy enhanced learning achievement of Grade Six students in Science.

2) Students showed remarkable satisfaction in learning Science on using Numbered Heads Together Strategy.

These findings were concluded upon the fulfillment of these two research objectives.

5.2.1 Research Objective 1

To examine the Grade Six Bhutanese students' learning achievement in Science through using Numbered Heads Together

Based on the data gathered through the Pretest and the Posttest, it was found that the use of Numbered Heads Together Strategy was efficient in enhancing the learning achievement of the learners in Science. The Pretest and the Posttest were administered and the scores were recorded accordingly. After analyzing and comparing of the Pretest and the Posttest scores it was found out that there was significant increase in the Posttest scores compared to that of the Pretest scores with a significance value of 0.01. The mean score for the Pretest and the Posttest was 8.56 and 14.81 respectively with the mean difference of 6.25. Thus, this clearly indicated that the use of Numbered Heads Together enhances the learning achievement of students in science.

The findings were parallel to the study carried out by Wora and Hadisaputro (2017), who focused on developing and enhancing the learning activity and achievement of a total of 30 students in a vocational high school located in the city of Surakarta, Indonesia, through application of Numbered Heads Together (NHT) approach. It was found out that the application of NHT teaching and learning model promoted engagement within the learning activity and enhanced the level of achievement.

The findings were also in line with findings of Corebima and Leasa (2017) who concluded that NHT learning model encouraged the students to cooperate in a group so well that it creates a meaningful learning process for them and enhances the students' cognitive achievement.

Moreover, these findings were similar to the findings of a study carried by S et al. (2017) that aimed to determine the effect of cooperative learning model Numbered Head Together and Talking Stick to the motivation and learning outcomes of Class Ten students. It was concluded that there was the influence of cooperative learning model Numbered Head Together towards students' motivation and learning outcomes.

The findings of this study were consistent with the findings of Heriwiyanti, Subroto, and Suprijono (2019), who found out that Numbered Heads Together teaching and learning model had a significant impact on improving 4th grade students learning outcome in social science.

Further, it relates with the findings of the study carried out by Dieker and Whiteney (2016) on the title Consultants and Co teachers Affecting Student Outcomes with Numbered Heads Together: Keeping All Engaged. They have discovered that an instructional strategy such as Numbered Heads Together (NHT) increased both academic and behavioral outcomes for students with and without disabilities. Thus, the Numbered Heads Together could enhance the learning achievement of the students in Science.

5.2.2 Research Objective 2

To explore the learning satisfaction of Grade Six Bhutanese students' on using Numbered Heads Together

The instruments used for the second objective of the study were Students' learning behavior observation and structured interviews. These instruments were used to obtain students' learning satisfaction on using Numbered Heads Together Strategy in Science. The data collected through these instruments were analyzed and interpreted. Through these instruments, it was found that the students who were taught using Numbered Heads Together showed remarkable satisfaction in Science. Children were fully satisfied with use of Numbered Heads Together Strategy in teaching Science from the data gathered through the behavior observations and structured interviews. From this it was concluded that the students were satisfied as they showed positive behavior towards being in the class of Numbered Heads Together. Moreover, after the analysis of data from the structured interviews, it was found out they gained the benefits in the following ways:

1) Promoted active participation and showed a greater degree of learning satisfaction.

2) It created lively classroom setting which made the mind of children to think like playing games. Moreover, sharing ideas made concepts clear.

3) It encouraged team work making them respect each child's views and it boosted their confidence in class participation.

4) It enhanced self learning and developed greater interest in learning through taking an individual role.

The findings for this objective was parallel with the findings of Mustami and Safitri (2018) as the incorporation of the NHT learning model into the ARIAS strategy made learning environment more conducive and livelier for the learners where students became more active and learning became more student-centered. The students attempted to master the materials because all the group members were given a responsibility to complete the task. Besides, the NHT also provided an opportunity for the students to share their ideas or opinions with each other which made them feel their importance of presence in the group which gave them sense of satisfaction. One way to improve the learning process and learning results is to use the NHT learning strategy.

The use of this model can make the learners to be involved in the thinking activity, so that they can be directly involved in the learning process. The involvement of students in the learning process can improve their understanding and knowledge. Thus, students can observe a process or event by themselves, so it will be an enriching experience and arouse their curiosity, and their ability to remember the learning material can be increased with greater satisfaction.

Further, this finding aligns with the Kolb (1984) experiential theory of learning which states that learning involves the gaining of knowledge that can be applied in a various range of situations and moreover, concepts are being driven from experiences.

Children tend to understand the abstract concepts better when they are made to experience by themselves thus, providing them with greater sense of satisfaction.

Moreover, children in the group seemed to be actively participating in the group activities and they were found to be taking active individual role for their own learning. It was claimed that children learn more through discussion and sharing of their views with their friends which is an indication of positive attitude towards Numbered Heads Together Strategy. It correlates with Sutipnyo and Mosik (2018) who reported that NHT learning strategy is one of cooperative learning models which enhances students' active participation, social interaction and academic achievement through joint cooperation. Moreover, it serves as alternate for the traditional classroom structure. It takes a greater role of altering the passive classroom setting into the lively classroom setting. Numbered Heads Together is not just confined to arranging students into groups, and it has been described as a tool to holistic development of concepts and ideas.

This finding supplemented the idea contributed by Laal et al.(2013) that the rationale of the learning in groups is to ensure that individual members to take part in the shared task and share their views with friends to make the concepts and ideas from the lesson clear with peers. It ensures that each team mate take charge of their share of the task in the team.

Children seemed to take a greater role of leading the group activities and active participation in the groups which boosts up their confidence for learning and to obtain shared goals. The high achiever supports the low achiever in learning the concepts in a better way. Thus, children learn to depend on one another. It is in line with Sim and Ananthi (2017), who stated that each member in the group must be aware that, to have a successful product of the team work, it depends on the hard work of each individual in the team.

5.3 RECOMMENDATIONS

Through this study, it was clearly known that the use of Numbered Heads Together Strategy was effective in improving the learning outcome of students and it showed greater satisfaction of the learners for learning Science. Having fulfilled both research objectives, the researcher would recommend the following points for practice and future research.

5.3.1 Recommendations for Practice

5.3.1.1 Numbered Heads Together Strategy enhances learning achievement of the students. Therefore, the science teachers should implement this strategy to teach Science.

5.3.1.2 NHT as an activity-based and student-centered strategy. It encourages active participation and facilitates individual accountability. So, this strategy can be used to promote class participation and individual role.

5.3.1.3 Numbered Heads together can be used in promoting communication skills and social skills besides learning the content.

5.3.2 Recommendations for Future Research

5.3.2.1 The researcher recommends that future researchers to study the effectiveness of Numbered Heads Together Strategy in other subjects with different grades.

5.3.2.2 This study was limited to 32 Grade six students. Therefore, future researchers are suggested to conduct research on similar topics with a larger sample size and also for longer time duration for more authentic results.

5.3.2.3 Future researchers can also collect their perception about strategy usage in the field and use what they have learned from this study to other researches they are interested in.

5.3.2.4 Collection of data is not just confined to instruments used by the researcher in this study. Other research instruments can be used for further findings.

As described earlier, Numbered Heads Together Strategy was found as a learner-centered, activity-based approach to boost students' academic performances. From this study, it was found that the use of NHT was effective in enhancing students' learning Achievement. Further, the students showed remarkable satisfaction of learning science on using Numbered Heads Together.

The learning environment should be structured in a learner friendly way that inspires learners to master both the content and the skills as demanded by the 21st century education. Moreover, the primary source of knowledge should not be teachers but should be more of exploration and hands-on experiences with the use of strategy like Numbered Heads Together.

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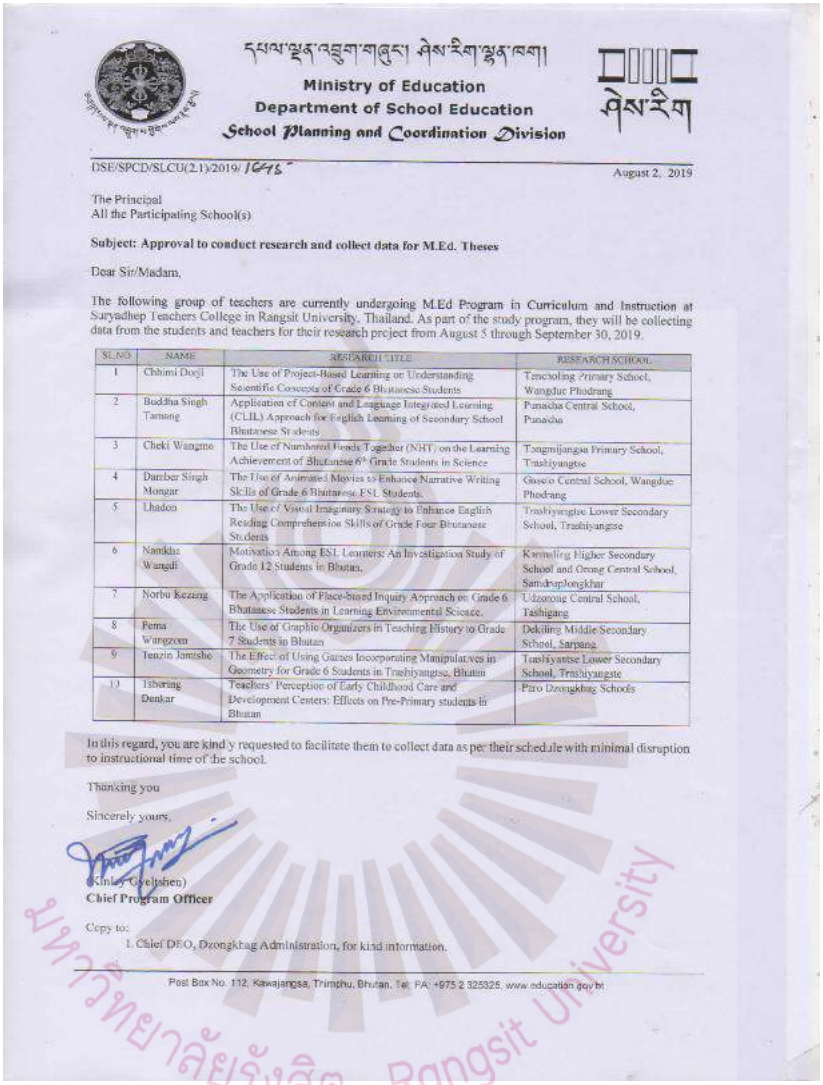
APPENDICES

APPENDIX A
LETTER OF APPROVAL



དཔལ་ལྡན་འབྲུག་གཞུང་། ཤེས་རིག་ལྡན་ཁག།
Ministry of Education
Department of School Education
School Planning and Coordination Division
ཤེས་རིག

DSE/SPCD/SLCU(2.1)/2019/1645

August 2, 2019

The Principal
All the Participating School(s)

Subject: Approval to conduct research and collect data for M.Ed. Theses

Dear Sir/Madam,

The following group of teachers are currently undergoing M.Ed Program in Curriculum and Instruction at Suryadhep Teachers College in Rangsit University, Thailand. As part of the study program, they will be collecting data from the students and teachers for their research project from August 5 through September 30, 2019.

SL.NO	NAME	RESEARCH TITLE	RESEARCH SCHOOL
1	Chhimi Dorji	The Use of Project-Based Learning on Understanding Scientific Concepts of Grade 6 Bhutanese Students	Tencholing Primary School, Wangdue Phodrang
2	Buddha Singh Tamang	Application of Content and Language Integrated Learning (CLIL) Approach for English Learning of Secondary School Bhutanese Students	Punacha Central School, Punacha
3	Cheki Wangmo	The Use of Numbered Heads Together (NHT) on the Learning Achievement of Bhutanese 6th Grade Students in Science	Tongmijangsa Primary School, Trashiyangtse
4	Dambar Singh Mongar	The Use of Animated Movies to Enhance Narrative Writing Skills of Grade 6 Bhutanese ESL Students.	Gaselo Central School, Wangdue Phodrang
5	Lhadon	The Use of Visual Imaginary Strategy to Enhance English Reading Comprehension Skills of Grade Four Bhutanese Students	Trashiyangtse Lower Secondary School, Trashiyangtse
6	Namkha Wangdi	Motivation Among ESL Learners: An Investigation Study of Grade 12 Students in Bhutan.	Kanmaling Higher Secondary School and Orong Central School, Samdrupjongkhar
7	Norbu Kezang	The Application of Place-based Inquiry Approach on Grade 6 Bhutanese Students in Learning Environmental Science.	Udzorong Central School, Tashigang
8	Pema Wangzom	The Use of Graphic Organizers in Teaching History to Grade 7 Students in Bhutan	Dekiling Middle Secondary School, Sarpang
9	Tenzin Jamtsho	The Effect of Using Games Incorporating Manipulatives in Geometry for Grade 6 Students in Trashiyangtse, Bhutan	Trashiyantse Lower Secondary School, Trashiyangste
10	Tshering Denkar	Teachers' Perception of Early Childhood Care and Development Centers: Effects on Pre-Primary students in Bhutan	Piro Dzongkhag Schools

In this regard, you are kindly requested to facilitate them to collect data as per their schedule with minimal disruption to instructional time of the school.

Thanking you

Sincerely yours,

(Kinley Gyeltshen)
Chief Program Officer

Copy to:
1. Chief DEO, Dzongkhag Administration, for kind information.

Post Box No. 112, Kawajangsa, Thimphu, Bhutan. Tel: PA: +975 2 325325, www.education.gov.bt

APPENDIX B

CONFIRMATION LETTER FROM THE RESEARCH SCHOOL

སྟོང་མི་བྱངས་སློབ་གྲྭ་ཆུང་བ། བཀྲིས་གཡང་རྩེ་རྫོང་ཁག།

TONGMIJANGSA PRIMARY SCHOOL
TRASHIYANGTSE

ཤེས་རིག

Sherig/TPS/Adm/07/2019/55 August 30, 2019

To Whom It May Concern

This is to officially state that Mrs. Cheki Wangmo, who is currently enrolled in the Master of Education in Curriculum and Instruction at Rangsit University, Thailand, has successfully completed data collection for her Thesis titled "The use of Numbered Heads Together (NHT) on the Learning Achievement of the Bhutanese 6th grade students in Science." from Tongmijangsa Primary School, Trashiyangtse, Bhutan on 30th August 2019.

(Wangchuk)
Principal

Cc to:

1. Person Concerned
2. The Chief DEO, Dzongkhag Administration, Trashiyangtse for kind information
3. Office file

APPENDIX C
CONTENT OF THE STUDY

Lesson no	Topics From Science Textbook	Time
1	Food for Plants	Week 1
2	Leaf-The Food Factory	Week 2
3	Transfer Pollens	Week 3
4	Dispersal and the Germination of the Seed	Week 4

APPENDIX D

SAMPLE LESSON PLAN

Class: VI

Date: ……. **Subject**: Science

Time: 80 minutes **Topic**: Foods for the plants

Strategy: Numbered Heads Together

Teaching Materials: chalkboard, chalk, chart, marker, projector, laptop, Plants

No. of students: 32

Previous Knowledge of the students: Students had done speaking activities and group discussions.

Objectives: At the end of the lesson, the students will be able to:

- name the nutrients required by plants for its healthy growth.
- explain the deficiency symptoms of the nutrients in the plants.
- list some chemical fertilizer.
- differentiate between natural and chemical fertilizer.
- describe the roles of nutrients for the proper growth of plants

Teacher's activities	Students' activities	Time
Lesson Introduction • Exchange greetings • Introduction and familiarization with research participants. • Ask the following questions to inquire about their previous knowledge. -Why is water important for plants? -Why do plants bend towards light? -What are nutrients?	• Exchange Greetings • Students listen to the questions and answer on Volunteer basis.	10 minutes

• let them look out of class. • Ask them what they can see outside the class. • Outline the lesson topic by relating to their responses based on what they see outside. • why plants are green? Sometimes plants seem to change their color into yellow why do think? • Today we are going to learn about food for the plants. **Lesson Development** • Gains attention (Ready to Rock) **Activity I** • Divide the students into groups of four and number 1 to 4 each of the member. • All the numbers 1 and 3 will be labelled as A, 2 and 4 as B. • Let them read the text for 10minutes. • Teacher bangs the table after 10 minutes to gain the attention. • Techer poses the question. Teacher hands in the question card consisting of 6 questions.	• Expected answers: due to lack of nutrients • Ready to roll	45minutes

• Think time: Teacher reminds them to think individually for 30 seconds. (no talking) • After that for 10 minutes students are going to write down their answer in their notebook individually. • 12...(gains attention after 5 minutes) • After 10 minutes students will come together to discuss their answers in the group. They make final decision of their answers to be presented. They discuss which one is the best. (10 minutes) • Teacher call for any number to present their work • (**3minutes each**) • Students will copy the final notes in their exercise note book for **5 minutes** **Activity II** • In a same group setting, Teacher ask them to draw and colour how plants look like without the presence of nutrient and why they need it **(8minutes)** • Think time: **10 seconds** (no talking)	• Eyes on you Discussion Presentation Listens to the instruction	20minutes

• Let them draw individually. Every one draws in their book. • After 5 minutes all the heads come together and select the best diagram and draw on the chart. • Teacher call one number from the group to represent group and share on the best diagram. **Lesson Closure** • Teacher closes lesson by recapitulating the main points taught. • Teacher ask few questions to check their understanding on the topic.	Shares Responds	5 minutes

APPENDIX E

LEARNING ACHIEVEMENT TEST

Learning Achievement Test

Subject: Science. **Maximum Marks: 25**

Class: VI. **Duration: 1hour.**

Direction: This paper consists of 15 multiple choice questions. Each question is followed by four possible choices of answer. Circle the correct answer. Each question carries 1 mark. Attempt all the questions.

1. The_____of plants is called as food factory.

A leaf
B root
C flower
D stem

2. The three important nutrients that plant required are_____

A cow dung, suphala and urea
B Chlorine, Zinc and potassium
C Calcium, Phosphorus and copper
D potassium, Phosphorus and Nitrogen

3. The process of preparing food by plants is called_____

A Cooking
B Respiration
C Reproduction
D Photosynthesis

4. The part of plants that transports water and nutrients to the other parts of the plant is_____

A Root
B Stem
C Leaf
D Flower

5. They have feathery stigma, long filament to hold anther and usually dull. These characters are posed by flowers pollinated by_____

A wind
B Insects
C Water
D Sun

6. The deficiency of _____in the soil results in the change in color of leaves to red and stem to purple.

A Sulphate
B Nitrogen
C Pottasium
D Phosphorus

7. The female part of flower is called_____

A style
B Stamen
C Carpel
D pollens

8. The transfer of pollens from anther to stigma is called_____

A Pollination
B Reproduction
C Fertilization
D Photosynthesis

9. A small new plants in a seed is called_____

A leaf
B fruit
C Embryo
D cotyledon

10. Leaves are green due to presence of_____

A water

B oxgyen

C nitrogen

D carbon dioxide

11. Fertilizers which come from living things like animal dung, compost, fish and bone meals are_____

A low fertilizer

B organic fertilizers

C inorganic fertilizers

D complex fertilizers

12. A gas which is given out during plants processes food is called_____

A oxygen

B nitrogen

C hydrogen

D carbon monoxide

13. In word photosynthesis 'photo' means_____

A. light

B. photograph

C. making

D. reproduction

14. The function of chlorophyll is to trap_____

A. oxygen

B. sunlight

C. water

D. nutrients

15. Food produced by farms without using chemical fertilizers and pesticides are called.....

A. organic food
B. solid food
C. good food
D. inorganic food

Short Answer Questions [5X2=10 marks]

Write the answers in space provided.

16. What do plants need for photosynthesis? (2m)

17. Draw a diagram of seed showing embryo and cotyledon of the seed. (2m)

18. Why seeds grow away from parents' plants? (2m)

19. What is germination? (2m)

20. Name two agents of pollination. (2m)

APPENDIX F

LEARNING BEHAVIOR OBSERVATION SHEET

Students' Learning Behavior Observation Sheet

Sl no	Learning behaviours	Yes	No	Not sure
1	Students willingly participates in in-class activities.			
2	Each child takes part in the classroom discussion			
3	Most students were engaged in the lesson throughout the class time			
4	Students appeared to understand the lesson material.			
5	Each child takes his role seriously			
6	Each child consistently and actively works towards group goal.			
7	Each child is willing to accept and fulfills the individual role within the group.			
8	Each child contributes ideas to the group without constant reminder from the teacher.			

APPENDIX G

STRUCTURED INTERVIEW QUESTIONS

Structured Interview

Interview Questions

1. Tell me about learning science through Numbered Heads Together?

2. How did you feel while learning science through Numbered Heads Together?

3. What do you like most about Numbered Heads Together strategy?

APPENDIX H

IOC RATING FOR THE DIFFERENT INSTRUMENTS

Item Objective Congruence for Lesson Plans by Experts

Item No	**Attributes**	**Expert**			**IOC average**	**Congruence**
		1	**2**	**3**		
1	Lesson plan 1	+1	+1	+1	1	Congruent
2	Lesson plan 2	+1	+1	+1	1	Congruent
3	Lesson Plan 3	+1	+1	+1	1	Congruent
4	Lesson plan 4	+1	+1	+1	1	Congruent
Total Value					**1**	**Congruent**

Item Objective Congruence for Students' Learning Achievement Test by Experts

Item no	Objectives	Experts			IOC average	Remarks
		1	2	3		
1	tell what is food factory.	+1	+1	+1	1	Congruent
2	name three nutrients required by plants for its healthy growth.	+1	0	+1	0.67	Congruent (Edited)
3	define photosynthesis.	+1	+1	+1	1	Congruent
4	name two parts of plants and its functions.	+1	0	+1	0.67	Congruent (Edited)
5	describe the characteristics of flowers pollinated by wind.	+1	+1	+1	1	Congruent
6	explain the deficiency symptoms of the nutrients in the plants.	+1	+1	+1	1	Congruent
7	name three parts of flower.	+1	0	+1	0.67	Congruent (Edited)
8	define Pollination.	+1	+1	+1	1	Congruent
9	name the two parts of seeds.	+1	0	+1	0.67	Congruent (Edited)
10	describe the roles of nutrients for the proper growth of plants.	+1	+1	+1	1	Congruent
11	differentiate between natural and chemical fertilizer.	+1	+1	+1	1	Congruent
12	name the raw materials and by products of the photosynthesis.	+1	0	+1	1	Congruent

Item no	Objectives	Experts			IOC average	Remarks
		1	2	3		
13	define photosynthesis.	+1	+1	+1	1	Congruent
14	explain what makes leaves green.	+1	+1	+1	1	Congruent
15	differentiate between natural and chemical fertilizer.	+1	+1	+1	1	Congruent
16	-name the raw materials and by products of the photosynthesis. -draw the equation of the process of photosynthesis.	+1	+1	+1	1	Congruent
17	draw the structure of the seed.	+1	+1	+1	1	Congruent
18	-describe two ways of seed dispersal.	+1	0	+1	0.67	Congruent (edited)
19	define germination.	+1	+1	+1	1	Congruent
20	name few agents of pollination.	+1	0	+1	1	Congruent
Total Value					**0.92**	Congruent

Item Objective Congruence for Students' Learning Behavior Observation Sheet by Experts

Item no	Learning behaviors	Experts			IOC average	Congruence
		1	2	3		
1	Students willingly participates in in-class activities.	+1	+1	+1	1	Congruent
2	Each child takes part in the classroom discussion.	+1	+1	+1	1	Congruent
3	Most students were engaged in the lesson throughout the class time.	+1	+1	+1	1	Congruent
4	Students appeared to understand the lesson material.	+1	+1	+1	1	Congruent
5	Each child takes his role seriously.	+1	+1	+1	1	Congruent
6	Child Consistently and actively works towards group goal.	+1	+1	+1	1	Congruent
7	Each child is willing to accept and fulfills the individual role within the group.	+1	+1	+1	1	Congruent
8	Each child contributes ideas to the group without constant reminder from the teacher.	+1	+1	+1	1	Congruent
Total Value					**1**	**Congruent**

Item Objective Congruence for Structured Interview by Experts

Item no	Learning behaviors	Experts			IOC average	Remarks
		1	2	3		
1	Tell me about learning science through Numbered Heads Together.	+1	+1	+1	1	Congruent
2	How did you feel while learning science through Numbered Heads Together?	+1	+1	+1	1	Congruent
3	What do you like most about Numbered Heads Together strategy?	+1	+1	+1	1	Congruent
Total Value					**1**	**Congruent**

APPENDIX I
LOCATION OF THE STUDY

APPENDIX J

PARENTAL CONSENT LETTER

Parental Consent letter

Dear Parents,

I am currently undergoing Master in Education in Curriculum and Instruction at Rangsit University, Thailand. In order to fulfill the requirement of my Master's degree, I am undertaking a research on "The Use of Numbered Heads Together (NHT) on the Leaning Achievement of Bhutanese Grade Six Students in Science".

This research study will involve teaching students using NHT strategy during the school hours for a period of four weeks for the month of August. With the purpose to collect reliable data for the abovementioned study, this study requires students to participate in structured interview towards the end of the study. The content of the teaching will be no different from what they are supposed to learn.

Therefore, I would like to seek your permission to let your child participate in this study. Their name and school will not be reflected in the final paper or presentation. I assure you that all the information provided by your child will be confidential. The confidentiality of your child's identity will be maintained through the use of numbers. So, if you agree to let your child participate, please sign the form below.

I greatly appreciate your support in this study.

Sincerely,

Cheki Wangmo

Researcher

Tongmijangsa Primary School

I acknowledge that the content of this research study has been explained. Therefore, I consent my child to participate in all the activities pertaining to the aforementioned research study. Signature: ----------

Name: ---------- Date: ----------

APPENDIX K

SAMPLE INTERVIEW TRANSCRIPT

Std no…1…..

1. Tell me about learning science through Numbered Heads Together?

Numbered heads together provides hands on experience and it engages us to learn through interacting with team mates.

2. How did you feel while learning science through Numbered Heads Together?

I enjoyed learning Science through Numbered Heads Together because it provided opportunity to help, get help and interact with our team mates and moreover sharing ideas with friends made me learn more

3. What do you like most about Numbered Heads Together strategy?

I like the last part where teacher call for any number to look for the responses as this activates everyone to be attentive in the class.

APPENDIX L

SAMPLE FILLED OBSERVATION SHEET

Students' Learning Behavior Observation Sheet

This study will also utilize students' learning behavior observation tool with the purpose to gather adequate qualitative data for the authentic research outcomes. The teacher researcher will use this tool to observe students' learning satisfaction on using Numbered Heads Together. The teacher researcher will observe students' learning behavior thrice. It will be carried out during the lesson 1st, 5th and 8th.

Sl no	Learning behaviors	Yes	No	Not sure
1	Students willingly participate in in-class activities.			√
2	Each child takes part in the classroom discussion	√		
3	Most students were engaged in the lesson throughout the class time	√		
4	Students appeared to understand the lesson material.	√		
5	Each child takes his role seriously			√
6	Each child consistently and actively works towards group goal.	√		
7	Each child is willing to accept and fulfills the individual role within the group.	√		
8	Each child contributes ideas to the group without constant reminder from the teacher.	√		

1st Lessons comments

-On using numbered heads together in science I can see an enormous difference in taking individual role. Each child in the class takes their role in the group actively and they could provide responses when ever their number is called for the presentation and sharing their group work.

-There was a strong teamwork amongst the group members. Everyone in the team supported one another in learning and carrying out the assigned task to achieve shared goal.

Initial of the observer.....

Date...7th Aug, 2019.....

BIOGRAPHY

Name	Cheki Wangmo
Date of Birth	September 2, 1991
Place of Birth	Trashi yangtse, Bhutan
Institution attended	Samtse College of Education, Bhutan Bachelor of Education, 2013 Rangsit University, Thailand Master of Education in Curriculum and Instruction, 2019
Scholarship	Thailand International Cooperation agency (TICA) scholarship, 2018
Address	Tongmijangsa primary School, Trashi Yangtse, Bhutan Chokeewangmo14@gmail.com
Position and Office	Ministry of Education, Education and Training Services, Teaching Service, Position:Teacher III