Faculty of Cognitive Sciences and Human Development

COOPERATIVE LEARNING: NUMBERED HEADS TOGETHER `S STRATEGY IN LEARNING MATHEMATICS AMONG SECONDARY SCHOOL STUDENTS

A CASE STUDY

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Bachelor of Education (Mathematics)
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This project is submitted in partial fulfilment of the requirements for the degree of Bachelor of Education (Honours) Mathematics

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This project entitled "Cooperative Learning: Numbered Heads Together `s Strategy in Learning Mathematics among Secondary School Students. A Case Study" was prepared by Norzubaidah Binti Ab.Halin and submitted to the Faculty of Cognitive Sciences and Human Development in partial fulfilment of the requirements for a Bachelor of Education (Honours) Mathematics.

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Statement of Originality

The work described in this Final Year Project, entitled
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is to the best of the author's knowledge that of the author except where due reference is made.

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14879

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Bismillahhirrahmanirrahim.
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All praises and thanks to God the Almighty for giving me strength, confidence and enthusiasm in my study and complication of my graduation project. Alhamdulillah, finally the project that had been struggled to complete came to it end.

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May God bless all of you, Amin.

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COOPERATIVE LEARNING: NUMBERED HEADS TOGETHER `S STRATEGY IN LEARNING MATHEMATICS AMONG SECONDARY SCHOOL STUDENTS

A CASE STUDY

Norzubaidah Binti Ab.Halin

This study aims to identify the use of cooperative learning by using Numbered Heads Together` strategy in learning Mathematics among secondary school students. The use of cooperative learning via this strategy was analyzed in terms of advantages (positive interdependence, individual accountability, equal participation and simultaneous interaction), disadvantages (time consuming, ineffective if students have poor social skill and encourage bad behavior) and effectiveness of this learning approach. These three criteria were chosen base on the framework identified by Spencer Kagan on 1992 (Waugh, 2003), Smaldino *et al* (2005), Bellanca & Fogarty (2003) and Johnson & Johnson (2004). In the attempt of data collection, the researcher carried out six experiments of cooperative learning via this strategy among From Two and From Four students in a secondary school at Kuching, Sarawak. Semi-structured interview and self-reflection inventory forms were used as instruments of this research. Based upon their academic achievement in Mathematics subject, a number of twenty respondents were interviewed. This process was recorded using tape recorder. The data were transcribed and later analyzed according to research questions. The finding indicated that most of the respondents believe the advantages of cooperative learning by using this strategy are positive interdependence, individual accountability, equal participation and simultaneous interaction. However, a minority of respondents claim that disadvantages of this strategy are time consuming, ineffective if students have poor social skill and encourage bad behavior. The result also showed that this strategy is an effective way of learning Mathematics among secondary schools. Finally, the researcher has come out successfully with views of cooperative learning by applying Numbered Heads Together `s strategy in learning Mathematics.

ABSTRAK

PEMBELAJARAN KOPERATIF: KAEDAH 'NUMBERED HEADS TOGETHER' DALAM MEMPELAJARI MATEMATIK DI KALANGAN PELAJAR SEKOLAH MENENGAH.

SATU KAJIAN KES.

Norzubaidah Binti Ab.Halin

Kajian ini bertujuan untuk mengenalpasti kegunaan pembelajaran koperatif dengan menggunakan kaedah 'Numbered Heads Together' dalam mempelajari Matematik dikalangan pelajar sekolah menengah. Kegunaan pembelajaran koperatif melalui kaedah ini di analisis mengikut kebaikan kaedah (saling membina, bertanggungjawab, penyertaan yang sama rata dan komunikasi yang serentak), keburukan kaedah (masa yang tidak dapat dikawal, tidak berkesan apabila diapplikasikan kepada pelajar yang mempunyai tahap pergaulan yang rendah dan menggalakan perangai buruk) dan keberkesanan kaedah ini. Ketiga-tiga kreteria tersebut telah dikenalpasti berdasarkan kepada Spencer Kagan pada 1992 (Waugh, 2003), Smaldino et al (2005), Bellanca & Fogarty (2003) dan Johnson & Johnson (2004). Bagi prosedur pengumpulan data, pengkaji telah menjalankan enam eksperimen tentang pembelajaran koperatif melalui kaedah ini dikalangan pelajar Tingkatan Dua dan Empat di sebuah sekolah di Kuching ,Sarawak. Sesi temubual separa berstruktur dan borang kajiselidik digunakan sebagai alat kajian. Berdasarkan pencapaian akademik terdahulu subject Matematik, dua puluh pelajar telah ditemubual. Kesuluruhan proses pengumpulan data ini direkodkan menggunakan parakam suara. Data yang telah direkodkan akan ditranskrip seterusnya di analisis mengikut soalan kajian. Hasil kajian menunjukan bahawa kebanyakan responden mempersetujui kebaikan pembelajaran koperatif adalah saling membina, bertanggungjawab, penyertaan yang sama rata dan komunikasi yang serentak. Namun, hanya segelintir responden mempercayai keburukan pembelajaran koperatif ialah masa yang tidak dapat dikawal, tidak berkesan apabila diapplikasikan kepada pelajar yang mempunyai tahap pergaulan yang rendah dan mengalakan perangai buruk. Hasil kajian juga menunjukan bahawa kaedah ini adalah satu kaedah yang berkesan untuk mempelajari subject Matematik di kalangan pelajar sekolah menengah. Akhirnya, pengkaji berjaya menghasilkan satu pandangan/pendapat tentang penggunaan pembelajaran koperatif melalui 'Numbered Heads Together` dikalangan pelajar sekolah menengah.

CHAPTER 1
INTRODUCTION

1.0 Introduction

This chapter discusses about the background of the study, research problem, objectives of the study, research questions, rationale of the study, conceptual framework, significance of the study, limitation of the study, conceptual and operational definitions of terms and conclusion.

In Mathematics, teachers play many roles such as making decision related to what to teach, what teaching materials to use and the best method to teach the selected content (Moore, 2003). The days of teacher standing in front of the room, giving lecture for 40 minutes and then assigning exercises in the text book are no longer effective for today`s students. Beside that, drill and practice is no longer an effective approach that can be applied on a daily basis with an expectancy of

excellent when it relates to Mathematical problem solving and deeply understanding of Mathematical concept. According to Macnab & Payne (2003), secondary school Mathematics becomes boring and difficult compared with the primary school. A Mathematics teacher should find an effective way to make learning process more meaningful.

According to Sutton & Krueger (2002, as cited in Cline, 2007), learning is an active process that allows students the opportunity to create understanding through empirical investigation and group interaction. Hanson & Silver (1996 as cited in Cline, 2007) claim that students should understand what they learn, make the connection that Mathematics is real and apply it to daily life. They recommend that Mathematics should provide challenging task and interesting where students can be actively involved. Cline (2007) states that cooperative learning actively involved students with other students in the classroom. This gives them an opportunity to demonstrate and use the knowledge they have learned. According to Moore (2003), teachers must manage a classroom environment. Thus, teachers are environmental engineers who organize the classroom space to fit their learning goals and to maximize learning. Moore (2003) also states that an emerging approach of grouping which is proving effective learning at both the elementary and secondary level is cooperative learning.

Generally, cooperative learning involves mixed-ability students work together to accomplish a set of task and achieve the learning`s goals. Besides that, Moore (2003) claims that rewards to individual student are usually based on the performance and achievement of the whole team rather than on that of individual team members, which provided motivation for students to work together productively. On other hand, Coronel, Carrasco, Fernandez & Gozalez (2003) state that in cooperation, the basic unit of learning is the group rather than the individual learner. This shift in the axis on which the work turns requires the concurrence of the principles such as moral support, increased capacity for reflection and continues improvement (Coronel *et al*, 2003)

Cooperative learning method promoted individual needs and interests in a group environment (Davidson & Kroll, 1991 as cited in Bosfied, 2004). Besides that, Arends (1997) said that cooperative learning developed to achieve at least three instructional goals which are academic achievement, acceptance of diversity and social skill development. Numbered Heads Together is one of the best strategies which can be applied in teaching Mathematics' concept (Kagan, 1994). A teacher can focus on one strategy of cooperative learning in teaching process to stimulate meaningful lesson.

1.1 Background

Mathematics is a very important subject and there have been a continuing controversy over Mathematics learning process, mostly in the computation skills. According to Cline (2007), build student's capacity for Mathematical thinking, there must be Mathematical communication. Sutton & Kruger (2002, as cited in Cline, 2007), claim that all students can learn Mathematics and all students need to learn Mathematics. Mathematic anxiety is a problem for many people. It can have harmful effects on students including feelings of stress, nervous and tension (Truttschel, 2002). Furthermore, the type of language used by teacher also effected student` s understanding of Mathematical concepts. There are many factors that contribute to students' Mathematical achievement such as understand the student`s differences in learning styles and needs, foster communication and develop a safe learning community.

According to Cline (2007), the Institute for Dynamic Educational Advancement (2006) reported that cooperative learning is an offshoot of constructivism. Bosfield (2004) claims the cooperative learning method was created in the late 1700s by Joseph Lancaster. Lancaster developed an apprenticeship system in which students get a lot of advantages from helping each other (Bosfield, 2004). Besides that, according to Kagan (1994), cooperative learning is a successful teaching method in which small teams, each student with different levels of ability and use a variety of learning activities to improve their

understanding of a subject. Kagan (1994 as cited in Cline,2007) stated that cooperative hard work result in participants motivated for sharing advantages so that all the students in a small group will gain from each other`s efforts, "your success benefits me and my success benefits you". Besides, each of the students, know that one's performance is equally caused by oneself and one's team members, "We can not do it without you". They also know that all group members share a common chance and feel proud and jointly celebrate when a group member achievement the success.

According to Lo (1991 as cited in Bosfield, 2004), educators of Mathematic in the 1980s make changes at teaching methods because students are unable to apply Mathematics to everyday experiences. In addition, Bosfield (2004) states that in 1993, a national report compiled by National Assessment of Education Progress found that students accomplish basic Mathematics computation in their examination, but were not able to apply Mathematics to everyday experiences. Boaler (1998 as cited in Bosfield, 2004) states that current study shows that teacher - centered learning method (traditional approach) places more emphasis on procedural knowledge that is of limited use rather than on understanding, thinking and reasoning.

The concept of constructivism is learning by doing which is related to cooperative learning. According to Kauchack & Eggen (2003), constructivists view learning as an active process in which the learners actively construct knowledge as they try to understand what is being experienced and the techniques involved. Besides that, constructivists believe students need to be participating fully in their learning. Harris & Graham, (1994 as cited in Kauchack & Eggen, 1994) said that participating fully will lead to deep, real, rich understanding and use of knowledge which will in turn guide to the ability to apply what is learned.

Kauchack & Eggen (1994) also said that other theories which are related with cooperative learning are Bruner in 1973 and Vygotsky in 1978. The idea of Bruner and Vygotsky is that learning happens most successfully when students

are actively engaged, working together, drawing from previous personal experiences to construct new knowledge and seeking to accomplish shared goals.

According to Kagan (1994), there are many cooperative learning`s strategy which are Numbered Heads Together, Turn To Your Neighbor or Think-Pair-Share, Pairs of Pairs, Inside-Outside Circle, Co-Op, T-Chart and Teams-Games Tournament. Kagan (1994) believes that each cooperative learning`s strategy has its own unique purpose and goal. The structure of Numbered Heads Together is derived from the work of Spencer Kagan (Bellanca & Fogarty, 2003). Since 1967, Kagan has focused his research on the structural approach to cooperative learning (Bellanca & Fogarty, 2003). There are four steps in Numbered Heads Together `s strategy which is numbering, questioning, head together and answering (Arends, 1997).

In the globalization world, the students should know how to apply the Mathematics concept in everyday experiences and it is necessary to use an effective teaching approach in order to lead a better understanding of Mathematics` s concept and higher achievement.

1.2 Research problem

Learning Mathematics involves remembering a lot of facts but also understanding the various concepts. In fact, not all students in one class have excellent ability in calculating and solving Mathematical problem. According to Lo (1991 as cited in Bosfield), since the 1980s, students have been lacking in the ability to apply Mathematical concepts to everyday life and teachers have felt the pressure to make changes in order to overcome this problem. In addition, the students feel bored and worried while working on Mathematics task. Mathematics anxiety is an extremely common phenomenon among students today (Perry, 2004). Mathematics anxiety is a problem. It can influence students' academic achievement and even contribute to stress, which is well known to cause many other problems (Truttschel, 2002).

Furthermore, the student`s performance and achievement in Mathematics when teaching in second language, English has shown an alarming decrease as measured state tests, report cards and daily and weekly assessments. This problem has an impact to the school, community and student`s futures. Secondary school students are expected to know basic mathematics' concept and apply the concept in multiple questions correctly. Due to students' lack of vocabulary knowledge and basic skill, the task of completing the question is extremely difficult. There are many possible factors that contribute to this problem such as direct instruction is only being the teaching style utilized, lack of practices and lack of knowledge among teachers in orientation to best practices in Mathematics.

In other to improve the student`s achievement in Mathematics, changes is needed. According to Cline (2007), 'insanity is doing the same thing over and over and expecting a different result'. He claims that, it is logical to consider that changes in teaching practices may have better results in student`s achievement especially in Mathematics. Bosfield (2004) believes that cooperative learning stimulates higher achievement compared to teacher- centered method. The increased usage of the cooperative learning method is a visible change within the area of learning Mathematics (Davidson & Kroll, 1991 as cited in Cline, 2007). Numbered Heads Together is one of cooperative learning which can be applied in teaching Mathematics' concept effectively (Gaikwad, 1996). In Number Heads Together `s strategy, students are given time and procedures for analyzing how their learning functions (Gaikwad, 1996). He also states that, the strategy not only focused on content that needs to be mastered but also the social skills that assist all group members to maintain effective working relationship within the group.

Teaching Mathematics involves creating, maintaining, enriching and adapting instruction to move towards Mathematical learning goals, capture and maintain interest and engage students in building Mathematical understanding. Cline (2007) claims that Kagan `s research on cooperative learning suggest that if cooperative learning is applied to the teaching of Mathematics, students`

Mathematics achievement might increase. The computation and the ability to analyze mathematical problems are important to their future education and in the work place. Therefore, this case study was carried out to solve this problem by investigating the use of Numbered Heads Together `s strategy in learning Mathematics among secondary school students.

1.3 Objectives of the study

The purposes of this study were to:

1.3.1 General Objective:

To study the use of cooperative learning which is Numbered Heads Together `s strategy in learning Mathematics among secondary school students.

1.3.2 Specific Objective:

i. To find out the advantages of cooperative learning by using Numbered Heads Together `s strategy in learning Mathematics among secondary school students.

ii. To find out the disadvantages of cooperative learning by using Numbered Heads Together `s strategy in learning Mathematics among secondary school students.

iii. To identify the effectiveness by applying cooperative learning which is Numbered Heads Together` s strategy in learning Mathematics among secondary school students.

1.4 Research Questions

The research questions were as follows:

i. What are the advantages of cooperative learning by using Numbered Heads Together `s strategy in learning Mathematics among secondary school students?

ii. What are the disadvantages of cooperative learning by using Numbered Heads Together `s strategy in learning Mathematics among secondary school students?

iii. What is the effectiveness by applying cooperative learning which is Numbered Heads Together `s strategy in learning Mathematics among secondary school students?

1.5 Rational of the study

The study of Numbered Heads Together's strategy was chosen because this strategy has high tendency to improve students` achievement more than traditional approaches (Johnson and Johnson, 2004). In addition, this strategy is suitable to apply in the teaching-learning process since it doesn`t consume much time. Mathematics is an uneasy subject to master by students. Therefore, a teacher needs to apply a helpful strategy in learning process. According to Johnson, Johnson & Holubec (1988 as cited in Gaikwad,1996), the main benefits of cooperative learning identified by the extensive studies are higher achievement, increased retention, greater use of higher level reasoning strategies, increased critical reasoning competencies and more positive attitudes toward subject areas. The design of this study was qualitative in order to develop a views of Numbered Heads Together` s strategy though interviews and self-reflection inventory .This techniques gave more meaningful and honesty feedback because it directly ask the respondents.

1.6 Conceptual Framework

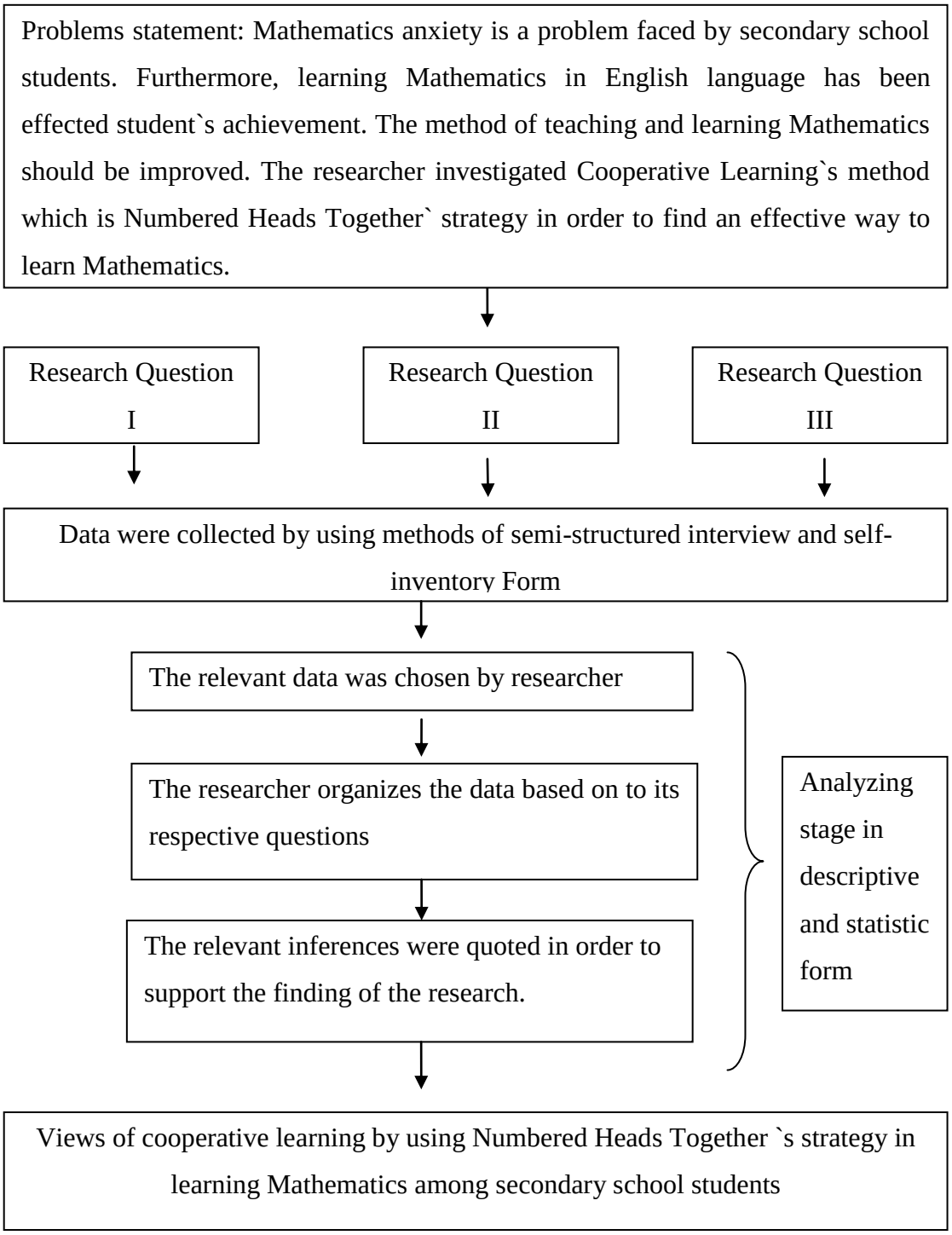

Figure 1.1: Conceptual framework

In this study, the respondents were from Forms Two and Four students in a secondary school at Kuching, Sarawak interviewed by researcher based on three research questions. The respondents also filled in the self-inventory form to support the finding. The data was collected represent the use of cooperative learning by using Numbered Head Together `s strategy in learning Mathematics among secondary school students. The collected data analyze in descriptive and statistic form. As the result from this study, views of cooperative learning by using Numbered Head Together's strategy in learning Mathematics among secondary school students was obtained.

1.7 Significance of the study

This study investigated the use of cooperative learning which is Number Head Together `s strategy in learning Mathematics among secondary school students. It is hoped that the study will provide important research relating to Mathematical achievement. Beside that, this is an academic area that is lacking research. The study was an effort to assist and guide the students' success in Mathematics especially among secondary school students. A teacher should use effective teaching methods that can help students and offer opportunities to learn in good environment that is nonthreatening and stimulating. This is very essential to unsure that the learning objective will achieve successfully. This study was value to teachers and administrators. The administrators can apply the result from this study to encourage Mathematics teachers at secondary school to use this learning strategy.

It is also hoped that the result of this study would present an elevated understanding of cooperative learning in teaching-learning Mathematics. According to Cruickshank, Jenkins and Metcalf (2003), cooperative learning is an effective strategy to create teams of musketeers who come to one another`s assistance and who succeed together no matter what the circumstances. This research brought relevant information needed for the transition period in Mathematical learning. Furthermore, the study investigated and focus on the

effectiveness Numbered Heads Together` s strategy which is one of the cooperative learning approaches. Thus, this study was valuable for future teacher training and development.

1.8 Limitation of the study

Since this study was conducted among Form Two and Form Four students, the range of age was limited to 14 and 16 years old only. The results would vary if this study was done by focusing on bigger age range such as adult group (19-23 years old). Besides that, the limitation of this study was the research was done in only one school in Sarawak which was located at rural area. The result of this study also would differ if the study was carried out at other secondary schools in Sarawak, town area and Malaysia at large.

Another limitation of the study was the research focused only on the academic area of Mathematic s' subject and selected respondents among secondary school students in a school. The findings of this study would different if were used bigger range of respondents and another subjects. In addition, interview technique that was used to collect data influenced the respondents to answer the question only based on the questions asked to them and some respondents not give full cooperation with the researcher. Besides that, the researcher has not enough time to collect all the data regarding to the study since time is limited.

1.9 Conceptual and Operational Definitions of Terms

The following terms was being defined to avoid confusion:

1.9.1 Cooperative learning

Conceptual definition terms:

A teaching arrangement that refer to small, heterogeneous groups of students working together to achieve a learning objectives. Students work together to learn and are responsible to their teammates (Kagan, 1994 as cited in Cline, 2007). According to Cline (2007), cooperative learning defines as a structured systematic instructional strategy in which small groups work together toward a common goal.

Operational definition:

Cooperative learning refer to teaching approach whereby the students working together to achieve a learning objectives in teaching and learning Mathematics among secondary school students in a secondary school in Kuching, Sarawak.

1.9.2 Numbered Heads Together.

Conceptual definition:

Numbered Heads Together is a strategy of cooperative learning developed by Spencer Kagan (1993) to involve more students in the review of materials covered in a lesson and check their understanding of a lesson`s content based on four steps which are numbering, questioning, head together and answering (Arends, 1997).

Operational definition:

Numbered Heads Together is a strategy of cooperative learning applied in teaching and learning Mathematics among secondary school to involve more students in the review of materials covered in a lesson and check their understanding of a lesson`s content based on four steps which are numbering, questioning, head together and answering