EFFECTS OF JIGSAW COOPERATIVE APPROACH ON YEAR FIVE PUPILS' HIGHER ORDER THINKING SKILLS IN SCIENCE

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FACULTY OF EDUCATION
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ABSTRACT

Science education encourages pupils to develop 21st century skills such as higher order thinking and cooperative skills. However, in science classrooms, pupils seldom work together. They prefer to listen and work individually; thus preventing pupils from developing their higher order thinking skills. The research objectives for this study were: (1) to investigate the effects of Jigsaw Cooperative Approach on Year Five pupils' higher order thinking skills (applying and analysing skills), (2) to describe Year Five pupils' cooperative skills when Jigsaw Cooperative Approach is implemented in Science lessons and (3) to examine Year Five pupils' perceptions on Jigsaw Cooperative Approach as a Science learning method. This study employed a quasi-experimental research design. A total of 70 Year Five pupils participated in this study, where 36 pupils were in the experimental group and 34 in the control group. In this study, Jigsaw Cooperative Learning was paired with Socratic Questioning to boost pupils' applying and analysing skills. During Jigsaw Cooperative Learning, teacher carried out Socratic Questioning with pupils to get a better understanding of the pupils' thinking perspective. Socratic Questioning had been taught as it can help pupils to promote their thinking systematically. The duration of this study was eight weeks. Data was collected using the Science Academic Achievement Test, classroom observations and a questionnaire. The pre-test and post-test scores between the experimental group and control group were analysed by using Independent T-test. The pre-test and post-test scores within the experimental group and control group were analysed by using Paired-samples T-test. The observation data was transcribed and coded whereas the questionnaire data was analysed by using descriptive analysis. The Independent T-test result showed that there was no significant difference ($t(68)=1.15, p>.05$) between the pre-test scores of

the pupils whereas there was a significant difference ($t(68)=3.90$, $p<.05$) between the post-test scores of the pupils in the experimental group and control group. The results of the Paired-samples T-test showed that there were significant difference between the pre-test and post-test scores within the experimental group ($t(35) = -15.05$, $p<.05$) and within the control group ($t(33) = -13.43$, $p<.05$). The data on pupils' cooperative skills were grouped into two themes. Pupils showed their improvement in playing their own role, involving actively in sharing information and working for a group task, respecting each other, helping each other, giving encouragement and exchanging ideas together from Cycle I to Cycle II. In terms of their perceptions, pupils felt happy to learn Science by using Jigsaw Cooperative Approach and this approach helped them to relate the knowledge that they learned with their daily life. Pupils applied their knowledge to solve the problems at the cognitive level of applying and analysing. The implication of this study is that it provides teachers with a guideline to do group activities and develop pupils' higher order thinking skills.

KESAN PENDEKATAN KOOPERATIF *JIGSAW* TERHADAP KEMAHIRAN BERFIKIR ARAS TINGGI DALAM SAINS UNTUK MURID TAHUN LIMA

ABSTRAK

Pendidikan Sains menggalakkan murid untuk meningkatkan Kemahiran Abad ke-21 seperti kemahiran berfikir aras tinggi dan kemahiran kooperatif. Walau bagaimanapun, murid jarang bekerjasama dalam mata pelajaran Sains. Mereka lebih suka mendengar dan belajar secara individu. Ini menghalang murid daripada meningkatkan kemahiran berfikir aras tinggi mereka. Objektif penyelidikan untuk kajian ini ialah: (1) untuk menyiasat kesan Pendekatan Kooperatif *Jigsaw* terhadap kemahiran berfikir aras tinggi (Kemahiran Aplikasi dan Analisis) untuk murid Tahun Lima, (2) untuk menghuraikan Kemahiran Kooperatif murid Tahun Lima apabila Pendekatan Kooperatif *Jigsaw* dilaksanakan dalam Pelajaran Sains dan (3) untuk mengkaji persepsi murid Tahun Lima terhadap Pendekatan Kooperatif *Jigsaw* sebagai Kaedah Pembelajaran Sains. Reka bentuk kajian ini ialah kuasi eksperimen. Seramai 70 orang murid Tahun Lima mengambil bahagian dalam kajian ini di mana 36 orang murid dalam kumpulan eksperimen dan 34 orang murid dalam kumpulan kawalan. Dalam kajian ini, Pembelajaran Kooperatif *Jigsaw* digabungjalinkan dengan Penyoalan Sokratik untuk merangsang Kemahiran Aplikasi dan Analisis murid. Semasa pendekatan Kooperatif *Jigsaw* dijalankan, guru telah mengadakan Penyoalan Sokratik dengan murid supaya dapat memahami cara pemikiran murid dengan lebih baik. Penyoalan Sokratik diajar kerana ia dapat membantu murid merangsang pemikiran mereka dengan sistematik. Tempoh kajian ini adalah selama lapan minggu. Data dikumpulkan dengan menggunakan ujian Sains, pemerhatian bilik darjah dan soal selidik. Skor bagi ujian pra dan ujian pasca antara kumpulan

eksperimen dan kumpulan kawalan dianalisis dengan menggunakan *Independent T-test*. Skor bagi ujian pra dan ujian pasca dalam kumpulan eksperimen dan kumpulan kawalan dianalisis dengan menggunakan *Paired-samples T-test*. Data pemerhatian ditranskrip dan dikodkan manakala data soal selidik dianalisis dengan menggunakan analisis deskriptif. Keputusan *Independent T-test* menunjukkan bahawa tiada perbezaan signifikan ($t(68) = 1.15$, $p>.05$) antara skor ujian pra murid sedangkan terdapat perbezaan yang signifikan ($t(68) = 3.90$, $p <.05$) antara skor ujian pasca murid dalam kumpulan eksperimen dan kumpulan kawalan. Hasil keputusan *Paired-samples T-test* menunjukkan bahawa terdapat perbezaan yang signifikan antara skor ujian pra dan ujian pasca dalam kumpulan eksperimen ($t(35) = -15.05$, $p <.05$) dan dalam kumpulan kawalan ($t(33) = -13.43$, $p<.05$). Data kemahiran kooperatif murid dikategorikan kepada dua tema. Murid menunjukkan kemajuan mereka dalam memainkan peranan masing-masing, melibatkan diri secara aktif dalam perkongsian ilmu dan menyiapkan kerja tugasan berkumpulan, hormat-menghormati, tolong-menolong, memberi galakan dan saling bertukar pendapat dari Kitaran I ke Kitaran II. Dari segi perspektif murid, murid berasa gembira dalam pembelajaran Sains melalui Pendekatan Kooperatif *Jigsaw* dan pendekatan ini membantu mereka untuk menggabungjalinkan pengetahuan yang mereka pelajari dengan kehidupan seharian mereka. Murid dapat mengaplikasi pengetahuan mereka untuk menyelesaikan masalah dengan mengimplementasi Kemahiran Aplikasi dan Analisis. Implikasi kajian ini ialah memberi panduan kepada guru untuk menjalankan aktiviti kumpulan dan meningkatkan kemahiran berfikir aras tinggi murid.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

In this science and technology era, our pupils face more life challenges and thus the teaching and learning of higher order thinking skills (HOTS) in Science are the focus in schools worldwide (Ebrahim, 2012). Pupils need to engage in higher levels of thinking so that they can implement their knowledge in different situations and make decisions when solving problems. In contrast, pupils who just memorise the facts and ideas would face difficulties when solving problems because they are not equipped with the relevant skills. According to Anderson et al. (2001), Revised Bloom's Taxonomy has six levels of thinking skills. This higher levels of thinking comprise of analysing, evaluating and creating skills (Anderson, et al., 2001).

According to Booysen and Grosser (2014), it is important that even young children should be introduced to these higher order thinking skills. Papalia, Olds and Feldman (2008) stated that children as young as eight-year old have developed 80% of their innate ability to learn. Therefore, higher order thinking skills should be exposed to these children to arouse the potential to think critical and creatively. Teachers play their part in equipping pupils with experiences that can help them to generate questions, reconstruct their own thinking, solve problems and make valid decisions in their own lives (Albaaly, 2012).

For children who always curious about their environment and like to ask questions, they acquire higher order thinking skills easily; in contrast it can prove to be difficult for others (Thomas & Thorne, 2009). According to Covey (2017), it is better if pupils could learn together to achieve these skills in a win-win situation.

Some research studies identified that to develop higher levels of thinking and to achieve greater learning outcomes, cooperative learning methods are more effective than either competitive or individual learning methods (Abdullah & Shariff, 2008; Souvignier & Kronenberger, 2007). The way to ask questions are important when pupils involved in cooperative learning approaches. Asking good questions enable pupils to receive the new information through conversations. Therefore, to help students to acquire the skills of asking questions, Socratic-style Questioning can be introduced. When pupils are exposed to this type of questioning techniques they are able pursue thought in different directions and for different purposes (Saleky, 2018).

In cooperative learning, pupils work collaboratively to fulfil the requirement of a structure group task. According to Zakaria and Iksan (2007), cooperative learning is the most effective when pupils take part actively during sharing information and working together to complete the group tasks. Pupils speak and listen to each other. The pupils would use language that are familiar to them to communicate with their group members. Therefore, cooperative learning creates the opportunities for pupils to engage in trying to solve the problems with the support and encouragement of group members (Zakaria & Iksan, 2007).

1.2 Background

At the primary education level in Malaysia, there exist two different types of schools: national schools and national-type schools. National-type schools are vernacular schools where pupils are taught in their mother tongue. The national-type schools in Malaysia include Chinese and Tamil type schools. Pupils use Mandarin to learn all the subjects except when learning language like *Bahasa Malaysia* and English in Chinese national-type schools. Pupils use Mandarin to learn Science.

The learning culture in Chinese national-type schools is influenced by China (Xia, Yang & Lee, 2018). Pupils at primary school are expected to study hard and to be hard-working and schools have extra classes almost every day after school hours. Competitive and individualistic behaviour and teacher-centred teaching are key features that dominate the culture of this type of school (Loh & Teo, 2017). Even though all primary schools in Malaysia tend to be exam-orientated (Lee,1993; Talib et al., 2014), pupils in Chinese national-type schools practised a less active learning strategy to compare to the other types of primary schools (Li, Chen & Duanmu, 2010).

Techniques for rote-memorisation still commands the teaching and learning process in Chinese national-type schools and teachers introduce peer competitions into the classroom to motive pupils to gain high scores for examinations (Wang, 2007). Thus, these pupils become passive and individualistic learners and are not willing to share knowledge with their peers (Sit, 2013). Therefore, it is difficult to promote both, cooperative and higher order thinking skills in primary Chinese national-type schools.

1.3 Problem Statement

In Chinese national-type schools, pupils' learning behaviours are influenced by Confucius heritage (Xia et al., 2018). This meant that pupils seldom learn actively in the classroom and many of them are reluctant to speak up (Abdullah, Bakar & Mahbob, 2012). They compete with each other and have been trained to be better than others (Loh & Teo, 2017). Pupils learn passively as teachers are looked upon as knowledge providers (Pujari & Rao, 2013). Pupils learn through rote memorisation. During class, pupils sit quietly, take notes, listen, and only ask questions, give suggestions, or reply when prompted (Abdullah et al., 2012). These pupils have

constantly experienced teacher-centred teaching and rarely worked together with their peers (Gilles & Boyle, 2010). The consequences of these actions are that pupils are dependent on their teachers for their learning (Zakaria & Iksan, 2007).

According to Zakaria and Iksan (2007), pupils who were not given the chance to share or transfer what they had understood in the lesson, would not have clear understanding of the topics learned. These culture should be improved so that pupils are actively involved and learn better in group activities. Gillies (2016) also stated that cooperative learning can be incorporated in various subjects as it promotes socialisation and learning among students from pre-school to university level. Students work with their group members, apply the knowledge in new situations, analyse the problems and solve it together. Other that just learning the content, pupils also have opportunity to develop their cooperative skills with their group members (Amedu & Gudi, 2017).

Howe and Abedin (2013) stated that pupils seldom practised the rich exchanges of ideas and opinions when working in groups. Some of the pupils worry that their peers would laugh at their opinions and suggestions and thus, lack the confidence to share information during the process of solving the problems (Mari & Gumel, 2015). Teachers found that pupils are quick to response to lower order questions correctly because it involved recall and memorization (Howe & Abedin, 2013). However, for pupils to learn to apply their knowledge and to analyse problems, teachers should play a role in guiding them to master the higher order thinking skills especially applying skill and analysing skill (Al-Miziny, 2010; Alwehaibi, 2012; Allamnakrah, 2013).

Based on the results released by the Organisation for Economic Cooperation and Development (OECD) in 2012, Malaysia scored 420 points compared to an

average of 501 points for Science in OECD countries under the Programme for International Student Assessment (PISA) among 15 years old students whereas pupils' performance in Science for The Trends in International Mathematics and Science Study (TIMSS) dropped from 492 in Year 1999 to 426 in Year 2011. Items in TIMSS depicted problems that rendered as higher order thinking questions and results clearly showed that Malaysia pupils' cognition level in Science has fallen drastically. Hence, higher order thinking skills especially applying and analysing skills should be enhanced among pupils. Although the results were drawn from secondary school pupils, there is need for interventions at a much earlier stage of their formal education. Hence, the Ministry of Education started to promote and enhance HOTS in primary schools by starting the new curriculum, Integrated Curriculum for Primary School (KSSR). However, many teachers have expressed concern if pupils are able to embrace these thinking skills (Collins, 2014).

Arase, Kamarudin and Hassan (2016) agreed that cooperative learning is suitable to provoke higher order thinking skills. Teachers should provide opportunities for pupils who seldom talk and share their ideas with group members. When pupils are compelled to discuss their ideas and thoughts with their peers, they would realise their misunderstandings and learn to evolve their ideas. In the topic of "The Earth, the Moon and the Sun" in Year Five Science syllabus, pupils cannot imagine the abstract phenomenon such as how the rotation and revolution of the earth because they do not see the real objects and these concepts are very remote from their daily lives (Kiroglu, 2015). With individual learning, they do not have the chance to voice out their curiosity and share their ideas. In contrast, with cooperative learning pupils can apply their knowledge and analyse the ideas and suggestions together. They learn to communicate with others by encouraging each other, be

patient when listening to each other's ideas and confident to give their own suggestions. Rommel (2010) also stated that the concepts of astronomy are hard to understand and explain. Pupils cannot imagine the occurrence of the moon phase by just reading the notes. Hence, pupils should work in groups so that they will have the opportunities to discuss and share their opinions and questions with their group members (Amedu & Gudi, 2017). This showed that pupils can learn this Science topic through cooperative learning which can enhance pupils' higher order thinking skills and these activities cannot be achieved by learning individually.

Even though cooperative learning has been introduced but it is not always successful. Altun (2017) stated that cooperative learning had a favourable effect on learning. Cooperative learning provided a supportive learning structure, opportunities to be successful, contributed to the development of social and personal skills, but could also be constant worry among pupils as it required pupils to be successful at all stages (Altun, 2017). Therefore, some pupils might not be interested with this learning method. This is due to some of them do not know how to promote questions and the way to cooperate with group members. Azmin (2016) stressed that teachers should develop some scaffolding techniques to be integrate with cooperative learning to ensure the approach is beneficial to the pupils.

Science is a part of life. Year Five pupils learn the topic of "Technology", which focus on the stability and strength of the building. To learn this topic, pupils are allowed to carry out many hands-on activities and experiments. These activities are important which enable pupils to explore and experience the facts of stability and strength (Yagci, Kapti & Beyaztas, 2012). With the cooperative learning, pupils apply their knowledge on stability and strength in the activities and then compare and contrast the results with others. Pupils can make conclusion with group members by

relating the results with daily life. This cannot be done if pupils do all these activities individually. With practising applying and analysing skills repeatedly in groups, pupils can enhance their higher order thinking skills.

To help pupils equip themselves with applying and analysing skills, Jigsaw Cooperative Learning should be included Socratic Questioning which may challenge the completeness and accuracy of their thinking when they discussed the Science content in groups. Therefore this study investigated the effects of Jigsaw Cooperative Approach on Year Five pupils' higher order thinking skills. In the context of this study, the HOTS would focus on applying and analysing skills. This was done because in Malaysian primary science syllabus, the thinking skills are focused on applying and analysing skills.

1.4 Objective of the Study

This study focused on three major objectives:

1. To investigate the effects of Jigsaw Cooperative Approach on Year Five pupils' higher order thinking skills (applying and analysing skills).
2. To describe Year Five pupils' cooperative skills when Jigsaw Cooperative Approach is implemented in Science lessons.
3. To examine Year Five pupils' perceptions on Jigsaw Cooperative Approach as a Science learning method.

1.5 Research Questions

1. Is there any significant difference between the post-test scores of experimental group and control group in terms of applying and analysing skills after the Jigsaw Cooperative Approach and conventional teaching was carried out?
2. How are Year Five pupils' cooperative skills when Jigsaw Cooperative Approach is implemented in the Science lessons?
3. What are Year Five pupils' perceptions on Jigsaw Cooperative Approach as a Science learning method?

1.6 Hypothesis

Ho = There is no significant difference between the post-test scores of experimental group and control group in terms of applying and analysing skills after the Jigsaw Cooperative Approach and conventional teaching was carried out.

H_1= There is a significant difference between the post-test scores of experimental group and control group in terms of applying and analysing skills after the Jigsaw Cooperative Approach and conventional teaching was carried out.

1.7 Significance of the Study

The results of the study would be of great benefit to the several groups. Based on the results, Jigsaw Cooperative Approach could develop pupils' higher levels of thinking which are crucial in 21st century life. To ensure pupils nowadays equip themselves with these skills, teachers apply the Jigsaw Cooperative Approach that will be able to train pupils better in mastering HOTS.

Year Five pupils will benefit from this study. In Year Five Science syllabus, the questions asked that involve higher order thinking skills are generally focused on applying and analysing skills. With the mastering of applying and analysing skills,

pupils may learn better the evaluating and creating skills. Besides, this study give pupils a realisation on the importance of cooperative skills among group members to make sure they learn from each other and able to work together. In cooperative learning, pupils learn the way to cooperate with group members, work in groups and how to learn and teach each other in groups. They also learn the way to promote Socratic questions which enable them to receive information in group discussion.

This study suggests a way for teachers in Chinese national-type primary schools to plan this teaching method in the development of pupils' HOTS in Science. Teachers were exposed to the procedures of Jigsaw Cooperative Approach. Teachers may change the way to teach pupils and the way to prepare group activities. Teachers may also identify and get some new ideas about the more efficient ways to instil HOTS. Besides, teachers may identify the pupils' perceptions on Jigsaw Cooperative Approach. This may provide a reference to teachers when they want to apply Jigsaw Cooperative Approach to improve pupils' higher order thinking skills by considering pupils' perceptions.

The results of the study could serve as a baseline data to improve the teaching and learning methods for school advancement. This data help school administrators to determine the strength and weakness of Jigsaw Cooperative Approach based on the responses of the pupils. It will also help determine what specific areas that should focus more and further enhance in order to make Jigsaw Cooperative more responsive towards preparing pupils in learning Science.

The results of this study also will help the curriculum planners appraise the existing syllabus in terms of the pupil's needs and abilities. After the consideration, they may make changes as required. This can ensure that the knowledge gained by pupils enable them to encounter challenges in their lives.

The findings of this study also contribute to the literature and serve as a basis for future researchers who study on teaching Science or carry out Jigsaw Cooperative Learning in Chinese national-type primary schools.

1.8 Scope of the Study

According to the Curriculum Development Division of Ministry of Education in Malaysia (2013), higher order thinking skills are the ability to apply knowledge, skills and values in reasoning and reflection to solve problems, make decisions, innovate and be able to create something new. These skills comprise applying, analysing, evaluating and creating. In this study, the focus is on applying and analysing skills because these two skills are emphasised more in primary schools. These two skills are the basic levels of higher order thinking skills before pupils equip themselves with evaluating and creating thinking skills. Pupils learn to apply the knowledge that they gain to solve the problems and in new situations and to collect and analyse information before making decision. As the applying skills and analysing skills are the dominant HOTS in primary school, the effects of Jigsaw Cooperative Approach on applying skills and analysing skills are investigated in this study.

Cooperative learning is a big concept which comprise of different types of learning. Thus in this study, one approach of cooperative learning, Jigsaw Cooperative Learning would be implemented. This is because with Jigsaw Cooperative Learning, students dependent on each other to succeed. Pupils in the classroom will be divided into heterogeneous groups to work on group tasks and achieve the group goals. (Moscardó, Rodríguez & Llopis, 2014). Each pupil in the classroom played an important role and took part in Jigsaw Cooperative Learning. With the cooperation of each member, every pupil can be succeed in their learning.

According to Johnson and Johnson (1999), there are five elements of cooperative learning. In this study, two elements of cooperative learning will be focused, they are positive interdependence and face-to-face interaction. Pupils rarely question or challenge knowledge transmitted by teachers and prefer to work individually (Sit, 2013). They spend much time to realise their own misunderstanding and do not know how to cooperate with each other to finish the group tasks. By focusing these two elements of cooperative learning, pupils are given the opportunity to contribute their knowledge, assign works and learn to depend on each other to complete the group task within the time given. They learn to encourage each other, share ideas in groups and help each other with their group members.

1.9 Definition of Terms

1.9.1 Higher Order Thinking Skills (HOTS)

Higher order thinking (HOT) is derived from the Bloom's taxonomy of cognitive domain introduced in 1956 (Forehand, 2010). There are six thinking skills in the revised Bloom's Taxonomy. There are remembering, understanding, applying, analysing, evaluating and creating.

Applying and analysing skills would be the focused on higher order thinking skills in this study. Applying skills involves pupils to apply their knowledge in new situation whereas analysing skill is the ability to compare and contrast, differentiate and relate the parts to an overall structure or purpose.

1.9.2 Cooperative Learning

According to Johnson and Johnson (1999), the five elements and requirements for the implementation of cooperative approach include positive interdependence, individual accountability, face-to-face interaction, social skills and evaluation of group processing.

In my study, two of the five elements of cooperative learning will be focused among Year Five pupils, that are positive interdependence and face-to-face interaction. Through the improvement of the dependence on each other and communicate with group members, the effects of cooperative learning on pupils' HOTS will be investigated.

According to Johnson and Johnson (1999), positive interdependence is linking students together so one cannot succeed unless all group members succeed. The group work benefits to students and their work benefits the group members. Positive interdependence can be structured through distributed resources, complementary roles, a mutual identity, and other methods of structuring positive interdependence.

Johnson and Johnson (1999) explained that face-to-face interaction promotes involvement and contribution in group work among students. Students are supporting, motivating and praising each other's efforts during the process of completing their group task. With this social interaction, students discuss the concepts, explain the ways to solve problems, teach each other, challenge each other's reasoning and conclusions and relate the new knowledge with past learning.

1.9.3 Jigsaw Cooperative Approach

In this study, Jigsaw Cooperative Approach means the integration of Socratic Questioning with Jigsaw Cooperative Learning. This learning is like a jigsaw puzzle, where the topic is divided into several subsections and then distributed to the pupils. Pupils studied the same subtopic in expert groups and then teach and learn from each other in the home group. According to Doymus, Karacop and Simsek (2010), Jigsaw Cooperative Learning is a structure and cooperative strategy that prevent the occurrence of the group learning problems.

Jigsaw Cooperative Learning which enable pupils to cooperate in learning will be focused in this study. Every pupil in Jigsaw Cooperative Learning will play an important role to convey new information to their group members. They also need to cooperate to achieve group tasks. For those who are passive learners and just waiting for the answers, they will be forced by their group members and realise their own responsibility in groups. Azmin (2016) had stated that some method or techniques should be focused or integrated with Jigsaw Cooperative Learning to ensure that it is beneficial to the students. Hence, to ensure pupils receive useful information in group discussion, Socratic Questioning had been integrated with Jigsaw Cooperative Learning.

Nappi (2017) stated that questioning is a main component to promote quality instruction and strategic thinking. According to Peterson and Taylor (2012), questions that are purposefully designed are benefit to teachers and students. In this study, Socratic Questioning will be integrated with Jigsaw Cooperative Learning so that pupils can experience in-depth theoretical and practical appraisals which can develop their higher order thinking skills. Elder and Paul (1998) created six types of Socratic questions, which are questions for clarification, questions that probe assumptions, questions that probe reasons and evidence, questions about viewpoints and perspectives, questions that probe implications and consequences and questions about the question.

In this study, teacher will introduce Socratic questions to the pupils and asks Socratic questions to elicit pupils' ideas through discussion. Pupils are encouraged to ask Socratic questions to elicit more information in sharing information session and in the process of working for a group task.

1.9.4 Conventional Teaching

According to Li (2016), conventional teaching is a teaching method that involves teachers and the students in a face-to-face manner in the classroom. Teachers teach in the classroom and focus entirely to the content in textbooks and notes. Pupils sit quietly and listen the teachers' explanation. Process of sharing information in the classroom is limited.

In my study, teacher will carry out conventional teaching in the control group. Teacher chooses activities and prepares learning materials whereas pupils work to find the correct answers. Teacher asks questions to lead pupils understand the content knowledge. Teacher also guides pupils to carry out activities according to the text book, take notes and answer the exercises in the activity books.

1.10 Limitation of the Study

The first limitation is the samples of this study. The samples were only limited to the Year Five Chinese national-type primary school pupils. In this study, the intervention, Jigsaw Cooperative Approach will be carried out specifically in the Year Five Science lessons only for the topic of "The Earth, the Moon and the Sun" and "Technology".

The second limitation is the sample size. There will only 70 pupils from the government Chinese national-type school involve in this study. This sample size is quite small in order to make generalisation based the effects on pupils' academic achievement through the implementing higher order thinking skills by using Jigsaw Cooperative Approach among Year Five pupils. The sample size should be in large amount so that the results will be more precise.

The third limitation is the location that this study be conducted. The samples were only from a Government Chinese national-type primary school at Pahang in

Malaysia. Due to the samples only from one state, the samples cannot be the representative of the rest of the population.

1.11 Summary

This chapter has described the foundation for this study, namely the problem statement, the objectives and research questions, the significance of the study as well as the terms that have been used here. The following chapter contains a literature review of studies on Jigsaw Cooperative Approach and higher order thinking skills. A background review of the theoretical framework and conceptual framework of this study will also be explained.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter begins with the definition of cooperative learning and Jigsaw Cooperative Learning, following by the cooperative learning's elements, advantages and disadvantages of cooperative learning, definition of Socratic questions and implementation of Socratic questions in Jigsaw Cooperative Learning. Moreover, the definition and importance of higher order thinking skills and the relationship between Jigsaw Cooperative Approach and higher order thinking skills will also be explained. Past studies of how to collect data were also reviewed in this chapter. The gaps will be identified and the framework for the research will be explained in detail.

2.2 Jigsaw Cooperative Approach

In this study, Jigsaw Cooperative Approach had been used as an intervention in the experimental group. Jigsaw Cooperative Approach was the primary approach where it was also integrated with Socratic Questioning for impactful teaching and learning. Pupils asked Socratic questions to promote thoughtful and relevant responses when Jigsaw Cooperative Learning was carried out.

2.2.1 Definition of Cooperative Learning

Panitz (1997) stated that there are differences between cooperative learning and collaborative learning. Collaboration is an interaction where individuals are responsible to their own behaviour in groups actions and respect the ability and contribution of their peers. Cooperation is more structure than collaboration. Pupils in groups work together to achieve the specific goal. Hence, pupils must play their own role and understand clearly about the group goals in cooperative learning.

One of the instructional methods that has been used in many subjects, with students from pre-school to university was cooperative learning (Slavin, 2015). According to Vaughan (2002), to maximise students' learning, students work in heterogeneous groups during cooperative learning. Pupils were given two responsibilities, firstly to learn the materials and secondly to teach their home group members and to make sure all of them learn all the subtopics.

According to Lightner, Bober and Willi (2007), cooperative learning proponents suggested that teachers should assign pupils to groups. This is better than random grouping or self-selection by pupils because this can avoid minority students from being excluded by others. Each group was heterogeneous based on academic achievement and the groups among themselves were homogeneous. Interdependence and face-to-face interaction are important in differentiating competitive learning with individual learning. Hence, the groups in cooperative learning should be heterogeneous so that pupils can learn from each other and communicate with others.

There are different types of cooperative learning including Student-Teams-Achievement Divisions (STAD), Team Game Tournament (TGT), Think Pair Share, Jigsaw, Round Robin and etc. In this study, Jigsaw Cooperative Learning was being selected as the research theme to assess the positive educational outcomes. The enhancement of the interdependency among pupils, pupils cannot succeed unless all group members succeed. Just like a single piece of jigsaw puzzle will have no meaning at all, but when all the pieces are put together, then only the big picture is revealed. Each pupil will make to realise that they are important to group success, they teach each other effectively with teacher's guidance, with a twist on the conventional teaching method, this will encourage them to involve more and learn better. Jigsaw Cooperative Learning provided the simulated environment for the

pupils where they learned the assigned subtopics and discussed their knowledge with the group members. Each pupil in groups was important to make sure what they learned in expert group will convey to the group members in their home groups. This had provided learning opportunities for the pupils who seldom involved actively in group activities, preferred to wait for answers from their friends and did not have the chance to voice out their opinions.

2.2.2 Definition of Jigsaw Cooperative Learning

Jigsaw Cooperative Learning was invented and developed in the early 1970 by Elliot Aronson and his students. Just like the jigsaw puzzle, each piece of puzzle is representing a student's part, which is crucial for the completion and understanding of the whole topic. Jigsaw Cooperative Learning can improve cooperative learning by ensuring each pupil accountable for explaining a part of the material to the group. The learning material to be learned was divided into several components. Pupils also spilt into two teams, "jigsaw group or expert group" and "home group" (Doymus, 2008).

Pupils in class were divided into several heterogeneous jigsaw group and each of them was assigned a subtopic. Each pupil had their own responsibility for each subtopic and learned together how to teach that subtopic in expert groups. They carried out discussion to learn and understand the information of the subtopic. Then, they returned to their home groups and shared the information of each subtopic. Group members must cooperate to achieve a common goal by depending on each other. This was because in the Jigsaw Cooperative Learning, each group member was interdependent to succeed. Everyone was essential and had to contribute to their groups. Hence, the group members will need to learn from each other and combine several chunks of information into whole (Aronson & Patnoe, 1997).

2.2.3 Elements of Cooperative Learning

Johnson and Johnson (1999) provided a framework that shows five elements of cooperative learning. These elements are positive interdependence, individual accountability, face-to-face interaction, social skills and evaluation of group processing. According to Johnson and Johnson (1999), positive interdependence meant pupils linked with others and cannot succeed unless they do. For example, there were six pupils in one group. Each pupil studied a subtopic and had the responsibility to teach the group members. They also learned different subtopics from other group members. If this pupil is unable to do well, then the other group members cannot succeed in learning on the whole topic. Individual accountability was the belief that everyone will be accountable for her/his performance and learning. Individual accountability existed when the performance of each pupil was evaluated and the results were brought back to the group and to the individual. Pupils understood their own role in teaching the new subtopic to group members. Face-to-face interaction provided pupils the opportunities by helping each other and encouraging each other's efforts to achieve successful. Social skills were the skills that required to provide effective leadership, decision-making, trust-building, communication and conflict-management. Evaluation of group processing happened when group members discussed their group achievement in their group goals and provided feedback to their group work.

2.2.4 Advantages and Disadvantages of Cooperative Learning

Brown and Mcllroy (2011) found that the role of competition to motivate pupils is one of the differences between cooperative learning and traditional learning approaches. They stated that setting competitive goals enable students to compete. However, in traditional learning, pupils will refuse to work harder if they are let to

complete tasks in groups because they will naturally wait for others. They feel they are in a disadvantage position if they are the first few to share knowledge in a group. They also do not know how to cooperate with others. However, there is no competitive instinct in cooperative learning because pupils are interdependence and they need to learn from each other. They also understand their own role in cooperative learning and know that the effort of each group member is important to make them successful in learning. So, they knew their goals and willingly took initiative in learning.

Researcher also found that when applying cooperative learning strategies, pupils' performed excellently. In contrast, teacher-centred classroom did not provide enough resources to broaden pupils' level of understanding. The major resource used in teacher-centred classroom was Science textbook. Teacher only focused on the information in the textbook. Information sharing among pupils were also limited in the teacher-centred classroom. According to Dingel, Wei and Huq (2013), cooperative learning should be implemented because it equipped pupils with the ability to derive deeper understanding of the topics. Pupils shared different information that they received from different resources. Hence, teacher should change their teaching method to ensure pupils can learn more efficiently in the lessons.

Pupils became more responsible in cooperative learning. Mehta and Kulshrestha (2014) found that pupils took the responsibility of their own learning with the implementation of cooperative learning in Science. They asked questions, stated problems and discussed their results with group members. Pupils were more positive with group members when they learned cooperatively. This promoted the success of all pupils in the classroom because it enabled pupils to learn to work with

each other and came out with the best solution for the problem faced. They understood and played their role in group work.

Tsay and Brady (2010) concluded that cooperative learning brought motivational effects. Ning (2013), Tsay and Brady (2010) and Summers and Turner (2011) also revealed that there was a very strong correlation between students' academic achievement and their motivation. With the motivation, students had better academic achievement because they became confident. Pupils promoted their ideas and suggestions clearly so that the group members can exchange their point of view together. Motivation and encouragement among each other were important so that pupils were willing to involve themselves actively in the group activities. Hence, cooperative learning that can bring motivational effects was able to enhance students' academic achievement.

Jigsaw Cooperative Learning was able to improve pupils' learning because it was less intimidating for many pupils, increased pupils' involvement, reduced the competition and made pupils less dependent on the teachers in the learning environment (Qiao & Jin, 2010). Pupils had the autonomy to teach and learn from each other in cooperative learning. Teacher acted as a guider. So, pupils felt more comfortable to voice out their point of view if only faced with their classmates. Each pupil in the classroom was taking part in Jigsaw Cooperative Learning and each of them had their own responsibility, they worked together and depended on each other. Cooperation was more than competition in Jigsaw Cooperative Learning.

Cooperative learning could enhance pupils' learning attitude. Chan, Ong and Salleh (2016) had carried out a study to examine how Jigsaw cooperative approach influenced Year Five pupils' attitudes towards Science. Twelve pupils from Chinese national-type school had been chosen. The findings of the study indicated that pupils

who had followed through Jigsaw Science lessons were more positive in their attitudes towards Science. They found that the increased responsibility towards friends, particularly in terms of assisting each other within the home groups and the used of Jigsaw Cooperative Learning increased student-student interaction in the classroom through discussion in cooperative learning. Hence, they strongly recommended to use Jigsaw Cooperative Learning in Science teaching.

In addition, Jigsaw Cooperative Learning also enable pupils to have broader understanding on the topic through cooperation with others. This affirmed that pupils who adopted Jigsaw Cooperative Learning are able to perform better in academic learning compared with another pupils who were taught through teacher-centred strategy (Robyn, 2014). According to Berger and Hänze (2015), novice pupils' academic performance increased with the quality of expert pupils' instruction by using Jigsaw Cooperative Learning method.

Astronomy was a difficult topic to learn as it involved many abstract concepts. However, learning about astronomy was important because it facilitated rational thinking and allowed for the understanding of the nature of science. As such, how accurately or effectively the topic astronomy was taught was vital because it can facilitate the learning of other abstract concepts in Science (Kıroğlu, 2015). To facilitate rational thinking, different point of views from group members were important. The opinions or suggestions from group members challenged their own thinking and then came out with the statements that agreed by each group members. Hence, learning the topic of Astronomy by using cooperative learning was better than individual learning. From the study done by Kanellidou and Zacharia (2019), the results had shown that the used of holograms and moving visualizations better supported pupils' learning. Static images were found to have the least effect on

pupils' learning. In cooperative learning, pupils carried out the simulations and experiments which involved each group member. Hence, cooperative learning fostered the learning of the topic of Astronomy.

The learning area for the topic of "Technology" in Year 5 Science syllabus is Strength and Stability. This learning area served as a foundation for pupils who learned Science in secondary school or higher education. This was because the topic under the theme of "Technology and Sustainable Life" will be continued in the Science syllabus in secondary school. In this learning area, it involved many hands-on and minds-on activities. This enabled pupils to explore the concepts by their own and not just dull study or memorising the facts. Due to some activities were complicated, some of the activities should involve two or more group members to ensure that the activities can be carried out smoothly. This was supported by Yagci et al. (2012), who said that courses with complicated structure such as Science and Technology required cooperation for pupils to learn the subjects. Through discussion and group work, pupils related the knowledge of Technology to their living environment.

However, novice pupils did not have better academic performance in more difficult subtopics. Ha¨nze and Berger (2007) stated that pupils have good performance in less challenging topics with the implementation of cooperative learning but not efficient for difficult topics because some of them cannot understand the learning materials well would feel demotivated. In this study, jigsaw participants performed better in the subtopic that they learned in the expert group compared to the pupils in the traditional classroom. However, pupils in traditional classroom performed better on another subtopics that jigsaw participants had been taught by another group members. Thus, the writer suggested that jigsaw technique need to be

developed further such as combining with another methods that might increase pupils' academic achievement.

This was supported by the research of Huang, Liao, Huang and Chen (2014). He stated that Jigsaw Cooperative Learning was favoured by both the low and medium achievement students. Individual learning was preferred by high achievement students because they felt that this method was not challenging for them. Therefore, the learning process should be modified to suit with the pupils' learning level. The good learning achievers stated that they started to explore different topics as the learning activity was related to the real lives and thus they preferred independent learning. The moderate and low learning achievers felt that the jigsaw-based group cooperation method was better than individual learning because each group member has their own tasks. Although some of the low learning achievers stated that these were difficult, they were able to discuss problems with group members, which resulted in a higher sense of achievement and involvement.

2.2.5 Socratic Questioning

In this study, Socratic Questioning had been integrated with Jigsaw Cooperative learning. The way to promote Socratic questions had been taught and teacher encouraged pupils to ask Socratic questions in group discussion to stimulate thoughtful and relevant responses.

2.2.5.1 Definition of Socratic Questioning

Socratic Questioning derived from the Socrates's teaching style (469–399 BC) who was a Greek philosopher and one of the founders of Western Philosophy. Socratic Questioning was an inquiry method that involve series of leading questions to receive different responses and to encourage rational thinking. (Carey & Mullan, 2004).

Elder and Paul (1998) introduced six type of Socratic questions, which were questions for clarification, questions that probe assumptions, questions that probe reasons and evidence, questions about viewpoints and perspectives, questions that probe implications and consequences and questions about the question. According to Elder and Paul (2007), thinking was driven by questions. To give the response on the Socratic questions, pupils apply their information and analyse the situation before making decision. This promoted pupils' higher order thinking skills.

Carey and Mullan (2004) also stated that questioning allows pupils to change their own minds. They concluded that pupils using Socratic Questioning were able to recognise some new understanding without the teachers telling them the conclusion. This was supported by Rhee (2007) who stated that Socratic Questioning was a method that enable to promote the learning process through probing pupils' thinking and reasoning in complex problems and structuring a problem-solving process. Pupils answered the Socratic questions based on their own opinion and existing knowledge. So, from the answers given by pupils, the pupils' understanding of the topics can be probed.

Ellerman, Denning and Hanna (2001) mentioned that Socratic Questioning engaged pupils in communicating with the teacher and other pupils. Teachers asked Socratic questions, drew out answers from pupils to challenge the completeness and accuracy of their thinking rather than provide pupils with the information or answers directly.

2.2.5.2 Implementation of Socratic Questioning in Jigsaw Cooperative Learning

Nelson (2009) asserted Socratic dialogue (using Socratic Questioning) as a method for teaching, based on inquiry, logical dialogue, reasoning together and evaluation of themselves and others. This student-centred approach was challenging

but engaged pupils in analytical discussions and aided in expanding their thinking skills when their group members asked Socratic questions. Teacher evaluated pupils' understanding of the ideas and content based on the answers given by pupils. During the group discussion in Jigsaw Cooperative Learning, teacher can guide pupils to address the learning tasks by using Socratic Questioning. In the process of sharing ideas, teacher and pupils promoted Socratic questions which can arouse their thinking, provide logical answers and give acceptable answers.

Yengin and Karahoca (2012) stated that Socratic Questioning was a two steps process. First, teachers used question and answer sessions to show pupils that their existing knowledge is not well developed or satisfactory to answer the questions' posed. Second, pupils learned to analyse the issue more detail and deeply to reach a solution or a statement and discover the knowledge. In Jigsaw Cooperative Learning, teacher elicited pupils' prior knowledge by asking Socratic questions. Then, pupils learned and practised Socratic questions in expert and home groups' discussion to recognise some conclusion without teacher telling them the conclusion.

Socratic Questioning provided an environment where the pupils required being more autonomous and taking control of their learning by discovering knowledge in dialectical dialogue (Yengin & Karahoca, 2012). In Jigsaw Cooperative Learning, teacher was only the guider or learning partner while pupils had autonomy in the learning process. They practised open-mindedness and had mature discussions when Socratic-type questions are asked. This enhanced pupils' deep thinking. This promoted motivation in learning as well as being a good match for satisfying the rules conditions of learning. This motivation promoted by Socratic questions was important in Jigsaw Cooperative Learning to enable pupils to be more confidence in cooperation with group members.

Socratic method is a strategy using thought-provoking question and answer sessions to promote learning. Socratic Questioning can persuade different thoughts among teacher and pupils or pupils with their peers especially in groups (Paul & Elder, 2019). In Jigsaw Cooperative Learning, pupils learned the subtopic in the expert group. Then, they taught this subtopic and learned another subtopics in their home group. In discussion, they promoted Socratic questions according to the topic for seeking thoughtful responses. Furthermore, Socratic questions also facilitated open-ended collaborative discussions and not competitive in nature. It helped to further learning by improving the pupils' reasoning and analytical skills. Pupils were encouraged to give textual evidence or references to support their answers, in turn brought about an in-depth examination and understanding of the ideas and content. They cooperated in sharing information and working for a group task to receive ideas from others. This can enhance cooperative learning to assist pupils developed their higher order thinking skills.

Besides, asking and answering questions were stressful to many students who worried their answer would be incorrect in traditional classroom. So, they preferred to sit quietly and to wait for the answers. Although pupils cooperated in cooperative learning, it was not efficient in learning if pupils discussed the questions out of the topics. So, it is important for them to learn Socratic questions that can help them to ask the questions related to the topics that they learned. According to Rhee (2007), students should practice Socratic Questioning to train themselves relate the abstract concepts with the real situation because it encourages and rewards higher-order thinking skills like evaluating, analysing, and applying. It helped pupils to develop the way of sharing ideas and their deep listening skills. In cooperative learning, pupils interacted with each other for sharing information and working for a group

task. It was important for each pupil to take turn in sharing and listening to each other's opinion. With the support of Socratic questions, pupils cooperated and interdependent on each other in their groups.

2.3 Higher Order Thinking Skills (HOTS)

Higher order thinking skills are important in this 21st century to ensure people are able to face the challenges in daily lives.

2.3.1 Definition of the Higher Order Thinking Skills

Higher order thinking (HOT) is derived from the Bloom's taxonomy of cognitive domain introduced in 1956. The six levels in Bloom's taxonomy included Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation. In the cognitive domain of Bloom's Taxonomy, the levels of Knowledge and Comprehension were corresponded to lower order thinking whereas Application, Analysis, Synthesis and Evaluation were corresponded to higher order thinking.

Anderson et al. (2001) had made a revised Bloom's Taxonomy and had transformed the initial six 'noun' terms that determined the levels into 'verb' forms. The thinking skills included are Remembering, Understanding, Applying, Analysing, Evaluating and Creating. According to British Council, higher order thinking skills can be defined in different ways but many educators split them into 4 groups, these were application, analysis, synthesis and evaluation. Application skill involved in problem-solving and experimenting whereas analysis was comprised of identifying patterns and organising ideas.

According to Sue (2019), HOTS was a concept popular in American education. HOTS include synthesising, analysing, reasoning, comprehending, application, and evaluation. The lower order thinking skills involved memorisation while HOTS require understanding and applying that knowledge. Tankersley (2003)

also stated that most jobs in the 21st century required the uses of highest levels of thinking-application, analysis, synthesis, and evaluation. So, pupils must equip themselves with skills since primary schooling.

Curriculum Development Division of Ministry of Education in Malaysia (2013) had stated that higher order thinking skills are the ability to apply knowledge, skills and values in reasoning and reflection to solve problems, make decisions, innovate and be able to create something new. In this study, applying and analysing had been focused and how well the pupils implement these skills in problem solving and decision making will also be identified.

2.3.2 Higher Order Thinking Skills in Malaysia Educational System

Started year 2013, the Ministry of Education Malaysia had plan to set 10% HOTS items in the UPSR exam papers, 20% in 2014 and 2015, and 25% in 2016. Through this progression, it allowed teachers and pupils to familiarise with the questions' of higher order thinking before further increasing the percentage of HOTS items into examination.

However, common issues faced by pupils in answering HOTS item were difficulty in describing their answers completely and less evidence provided to support their answers. Therefore, many teaching and learning approaches had been introduced to the teachers and student-centred teaching method is compulsory to be implemented. Furthermore, cooperative learning was one of the learning method which encouraged the sharing information and able to enhance pupils' cognitive development (Saputra, Joyoatmojo, Wardani & Sangka, 2019).

According to the annual report of Malaysia Educational Blueprint 2013-2025 (2015), it showed only 61.8% of teaching aspect had incorporated HOTS elements in activities such as group work, classroom games, presentation and classroom

questioning. Then, 63.2% of pupils learning aspects included HOTS elements in answering the questions and pupils' assignment. These showed that HOTS which were emphasised were in moderate level. The observation also showed school-based assessment contained more than 40% higher order thinking skills items for the subjects of *Bahasa Malaysia*, English, Science and Mathematics (Malaysia Educational Blueprint 2013-2025, 2015). Among six thinking skills, "application" was the most dominant cognitive levels. Pupils needed to improve their applying skills and follow by analysing skills. Teachers should encourage pupils to practice it in the classroom.

2.3.3 Importance of Higher Order Thinking Skills

Saido, Siraj, Nordin and Al_Amedy (2018) carried out a study to examine higher order thinking skills among secondary school pupils in Science learning. The findings revealed that 278 (79.7%) 7th grade pupils were at lower level of thinking skills. The results showed that almost all students needed to improve their HOTS especially the applying and analysing skills which were the base level of HOTS before they developed their synthesis and evaluation skills in secondary school. This result revealed that even secondary students cannot master higher order thinking skills thoroughly, then how about primary pupils?

With the mastering of HOTS, pupils' academic achievement can be enhanced. Chidozie, Libunao, Kamen and Saud (2014) had suggested that HOTS should be focused and included into the process of teaching and learning. With the mastering of HOTS, pupils are able to complete their homework unaided. This was supported by Rajendran and Idris (2008) who stated that the mastering of thinking skills could enhance pupils' academic achievement. He mentioned that pupils who were trained to think well able to solve more complex problem solving compared to others. So,

the development of thinking skills is crucial and can only be achieved through the integration of thinking skill into the subject content, not just through drill method.

According to Rommel (2010), compared to other concepts in Science, astronomy concepts were more difficult to understand and to explain to pupils, and they required an upper-level 'cognitive skill' for their comprehension. Thinking skills were required to make sure pupils understand the concept well. Hence, astronomy education fostered the development of the HOTS of pupils (Uçar & Demircioğlu, 2011). Thinking skills should be emphasised and integrated with this subject content. These were the reasons why researcher chose "The Earth, the Moon and the Sun" as a topic for the intervention. This was also supported by Rajendran and Idris (2008) who stated that when the existing knowledge was not enough for pupils to face the new challenges, higher order thinking played an important role to expand the use of mind. Pupils started to practise different ways such as identifying the problems, analysing the problems, relating problems to the previous knowledge, compare and contrast the decision that will be made and etc.

2.4 Relationship between Jigsaw Cooperative Approach and Higher Order Thinking Skills

According to the Veldman, Doolaard, Snijders and Bosker (2019), the results of their study suggested that cooperative learning activities contributed to pupils' high-level talk. High-level talk was characterized by pupils expressing elaborated responses by using HOTS. In the high-level talk, pupils explained the ideas in details to make sure all the group members understood well. They also elaborated their opinions according to their own understanding to convince each other. The sample of the study was Grade 1 students (6- and 7-year-old children) who worked in small groups of four over a whole school year. The study showed that an effective cooperative learning can foster the development of primary pupils' interaction. The findings of

this research showed that children of approximately 6 and 7 years old were able to explain their propositions and gave reasons for their arguments. With cooperative learning, pupils learned to interact with group members and involve themselves in the group activities. Therefore, the recommendation is to implement cooperative learning in educational practice for young-aged students in elementary schools.

Tan (2020) carried out a research on improving Logical Thinking Skills through Jigsaw-Based Cooperative Learning Approach. This study believed that this approach guide the students to grasp and build their logical thinking skills, which is the higher order thinking skills. This approach also helped to stimulate and firmed-up the process of sequential logical thinking skills. Hence, cooperative learning, especially Jigsaw Cooperative Learning can be implemented to develop pupils' higher order thinking skills.

Socratic questioning had been implemented in Jigsaw Cooperative Approach in this study. According to Paul and Elder (2019), Socratic questioning induced thought in different directions and for many purposes among teacher and pupils or pupils with their peers especially in groups. In groups, pupils exchanged ideas, changed their own minds and learned something new by promoting Socratic questions. Hence, they developed their higher order thinking skills together.

There were only applying skill and analysing skill being focused in this study. According to Areesophonpichet (2013), among the HOTS demanding to be honed in the 21st century are analytical skills. Before pupils mastered with analysing skill, they must learn the applying skills which enable them to apply their existing knowledge in new situation so that they can analyse the problems more clearly. Applying skill is the skill to carry out or to use a procedure through execution or implementation while analysing skill is the skill in breaking down some information

into smaller elements to determine their interrelations (Krathwohl &Anderson, 2010). In this study, Jigsaw Cooperative Approach had been chosen and implemented to develop pupils' applying and analysing skill.

2.5 Past studies on How to Collect Data

Alshammari (2015) had carried out a study to investigate the effects of cooperative learning on academic performance of the students. Four sets of pre and post-tests were administered to both the experimental group and the control group, and the results were compared to determine the effects of cooperative learning on the result of the test. The results showed that the students in the experimental group consistently scored higher on the post-test if compared to those in the control group. Hence, cooperative learning brought positive effect of improving the students' academic performance. This indicated that pre-test and post-test can be used to examine the effects of cooperative learning implementation on pupils' academic achievement.

Adams (2013) carried out a study with the aim to improve upon cooperative learning with the implementation of Jigsaw technique among Year Six pupils. The research instruments that had been used included questionnaire and observation. Jigsaw technique was the intervention. The data from the questionnaire showed that ninety percent of the respondents overwhelmingly agreed that jigsaw technique helps to promote cooperative learning to a higher extent. The researcher observed how the pupils cooperate or give information. The researcher observed their behaviour according to the check list. Interaction between group members had been recorded. The observation data showed that most of the pupils answered questions actively during and after the lesson. This study also showed that observation was suitable to

be used in observing how pupils cooperate in groups and questionnaire was suitable to be used in collecting pupils' perceptions.

A rubric is a great tool for teachers because it is a simple way to set up grading criteria based on pupils' performance. In this study, researcher also used rubric to evaluate Year Five pupils' cooperative skills when Jigsaw Cooperative Approach was implemented in Science lessons. Khalid (2016) carried out a study that used surveys, interviews, tests, interviews, rubrics and observations to collect data and answer the research questions. The researcher used rubric in his observation to observe the effectiveness of Cooperative Learning implemented in experimental group of this research. The rubric examined five elements of cooperative learning. There were three scales in the rubric, 1=beginning, 2=developing and 3=accomplished. The rubric was used to evaluate students' cooperation. Students were seen to fairly improve after intervention. Rubric enable the researcher to identify the progression of the students in their cooperation.

There were two elements of cooperative learning being focused and being observed among pupils in this study. It included positive interdependence and face-to-face interaction. Scager, Boonstra, Peeters, Vulperhorst and Wiegant (2016) carried out a research to find factors that enhanced pupils' collaboration or cooperation. From the result, the collaboration processes used by these pupils were distinctly effective and positive interdependence was clearly presented, supported the notion that positive interdependence was an important factor contributing the effectiveness of collaboration or cooperation (Johnson and Johnson, 2009).

Face-to-face promotive interaction had been chosen because only with positive interaction, pupils who are passive can change their learning style and got benefits in cooperative learning. According to Kristiansen, Burner and Johnsen

(2019), the factors of face-to-face promotive interaction that led to successful cooperative learning in small groups were pupils' interpersonal behaviour, experiences, communication and support, and teachers' influence that in turn can lead to deep learning. Teachers and pupils must always ready with the interaction in cooperative learning.

2.6 Theoretical Framework

Social Development Theory, which was a theory contributed by Lev Vygotsky (1896-1934) was best suited to explain this study. Vygotsky (1978) suggested that there is a close relationship between the use of language as a cultural tool (in social interaction) and the use of language as a psychological tool (for organising our own, individual thinking). He also proposed that through the involvement in joint activities, new understandings can be generated which then "internalise" as individual knowledge. His theory focused on three main themes, namely social interaction, more knowledgeable other (MKO) and Zone of Proximal Development (ZPD).

Vygotsky (1978) stated that social learning preceded a child's cognitive development. He also stated that the cognitive development of children started the interaction with others (inter-psychological) leading to children's development within themselves (intra-psychological). Through interaction, pupils communicate and share their ideas with friends which will foster their learning. Since interaction is a well-established criterion in effective learning, cooperative learning which focused on small group interaction is a suitable learning approach to improve pupils' academic success (Parveen & Batool, 2012), providing motivation (Kus, Filiz & Altun, 2014) and adopting cooperative working habit (Rienties, Tempelaar, Bossche, Gijselaers & Segers, 2009).

The More Knowledgeable Other (MKO) is any individual who has a better understanding and ability level in a particular task, process, or concept. The MKO can be the teacher or peers. Vygotsky (1978) also stated that ZPD is the distance between the actual development level as determined by individual problem solving and the potential development level as determined through problem solving under adult guidance and/or with peer collaboration.

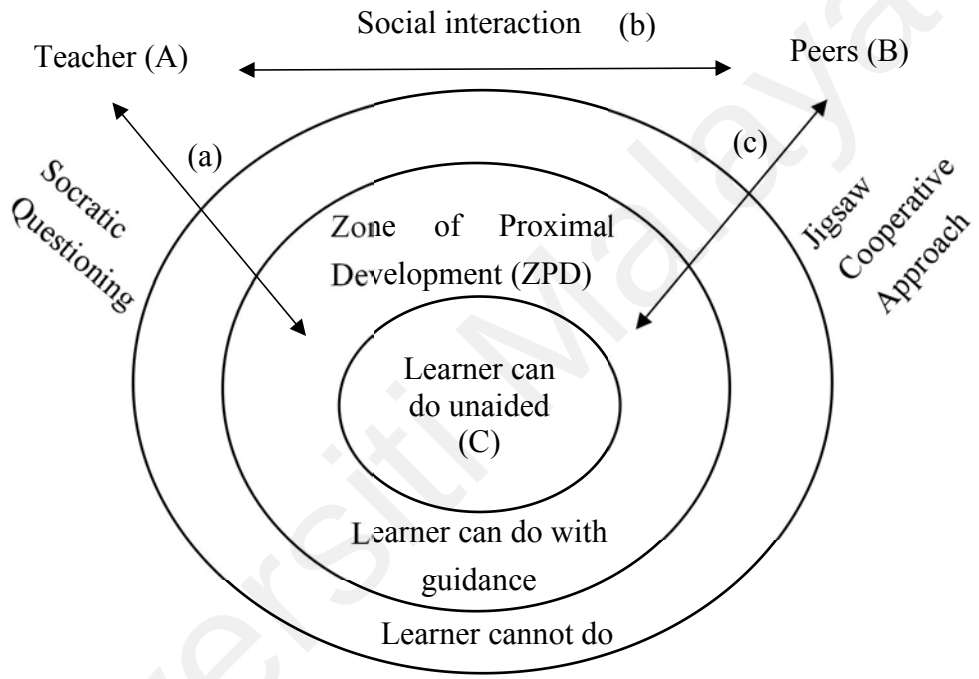


Figure 2.1 Zone of Proximal Development. Adapted from Vygotsky (1978).

When pupils in the ZPD received appropriate assistance, the pupils were able to achieve task. Generally, Vygotsky used the term MKO which might include teacher (A) and their peers (B). The more skilled learners who gave the assistance was called as "scaffolding". By using Jigsaw Cooperative Approach, big chunks of knowledge were distributed among pupils in each group. Then, they learned from each other and synthesised the knowledge as a whole. Teacher guided pupils to understand the meaning of the keywords in the subtopics. Teacher would prompt some ideas when she noticed that pupils did not know what can be discussed in the

group. These types of scaffoldings were important to make sure the discussion on the content of the topic was relevant. Pupils also received scaffold from their peers. Pupils reminded their group members which was the important notes for the topic and guided their group members to carry out activities and experiments correctly. Once pupils were able to master the knowledge, the "scaffolding" will be removed.

In this study, pupils constructed their own knowledge through guidance (scaffold) and not just facts memorisation. The double sided arrow in Figure 2.1 showed that pupils had more autonomy in learning by exploring the knowledge through interaction with teacher (A) and peers (B). The interaction between teacher and pupils (b) or pupils and pupils (c) were in two ways transmission (shown by double sided arrows). Teacher moved around, interacted and provided guidance to the groups which were needed. Teacher also asked some questions to test the understanding of the pupils to make sure they were in the correct way of discussion. Meanwhile, pupils interacted with their group members in the process of sharing information and worked together to achieve goal.

Teacher emphasised on Socratic questions (a) in the process of Jigsaw Cooperative Learning. Once Socratic Questioning being introduced, teacher would also train pupils how to promote Socratic questions. Then, teacher elicited pupils' ideas by asking Socratic questions. From the answers given by pupils, teacher understood the where pupils misunderstand. Teacher will then discussed this Socratic questions after the intervention to identify pupils' learning of new information. During information sharing in the expert group and home group, pupils asked and answered the Socratic questions, promoting their thinking. They clarified the information by comparing and contrasting their own ideas with others. Teacher also asked Socratic questions during the group discussion by the pupils. Through the

social interaction between pupils and teacher, teacher understood their pupils' ability, supported pupils to help on each other in the learning process and built on their own knowledge together. Besides, teacher always pay attention on the pupils who are not confident or reluctant to talk and their peers (B) whether they are confidence and be able to understand the topic well during sharing session in groups. Teacher also motivated them to cooperate together to achieve the task. So, the pupils guided or helped each other in groups.

In addition, pupils' learning was scaffolding through Jigsaw Cooperative Approach (c). When pupils were asked to read or understand large amount of information, they normally could not comprehend and eventually lose interaction with group members. This made the learning outcome unachievable. If pupils were given a small piece of familiar information and then to interact with their group members (who also did the same), the knowledge gained would be enhanced. Pupils interacted and supported their peer learning by sharing ideas, building up understanding, solving problem and making decision together where applying and analysing skills were implemented. This can be done with guidance.

Once pupils were able to apply knowledge unaided, the scaffold can be removed. Pupils can do unaided (C). Thus, Vygotsky's theory served as a theoretical foundation for Jigsaw Cooperative Approach. In this study, this theoretical framework helped in designing Jigsaw activity. Social interaction occurred in Jigsaw Cooperative Learning and it stimulated the cognitive development. Hence, the communication and interaction among group members in Jigsaw Cooperative Approach was focused. During information sharing and group task, pupils promoted the Socratic questions and helped each other to expand thinking. They acted as the more knowledgeable one as compared to others in their groups.

2.7 Conceptual Framework

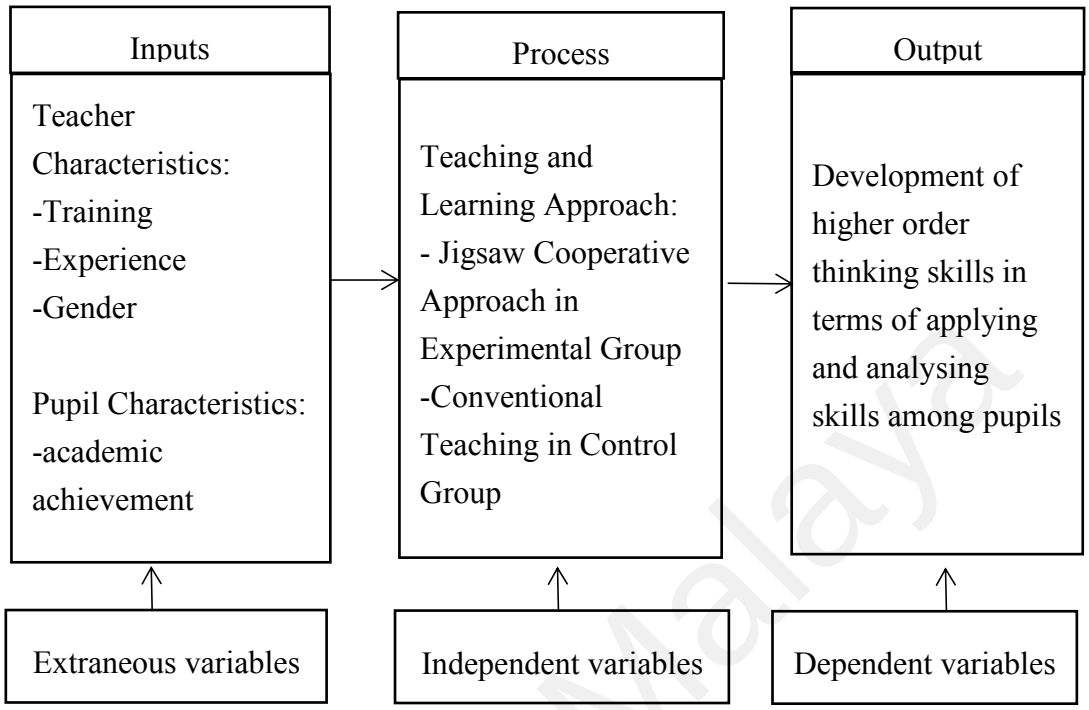


Figure 2.2 The Conceptual Framework of the Jigsaw Cooperative Approach as an Intervention on the Development of Higher Order Thinking Skills

The conceptual framework of this study adapted the systems theory that was developed by Ayot and Patel (1992). According to the Figure 2.2, these conditions are fulfilled with inputs which included teacher and pupil characteristics, these are extraneous variables. The process is the teaching and learning approach which included Jigsaw Cooperative Approach and conventional teaching, these are the independent variables of this study. The output is the development of HOTS in terms of applying and analysing skills among pupils, also known as dependent variables.

The extraneous variables in this study were teacher characteristics and pupil characteristics. To control pupils characteristics, Year Five pupils with different academic achievement had been placed in the experimental group and the control group. There were six heterogeneous groups which comprised same amount of pupils in the aspect of academic achievement in the experimental group. To control teacher

characteristics, only trained teachers with more than ten years teaching experience were participated in this study. This controlled for the gender, training and experience of the teachers.

In the current classroom, teachers had more autonomy in the learning process and this leads to pupils being passive (Pujari & Rao, 2013). Pupils always learn individually and rarely be given opportunity to work together with peers. These caused pupils lack of confidence to share their ideas and suggestions in front of their friends (Mari & Gumel, 2015). Without sharing and teaching others, pupils cannot remember and apply the knowledge well, making them lack of the capability to think.

As we know, higher order thinking skills is important and cannot be separated from our daily lives. It empowered pupils to ask questions, solve problems, apply skills to make decisions and to access information for use in new context or new situations. It should be learned formally in school so that pupils are more ready for the lifestyle and challenges presented in the 21st century.

The gap that had been identified was pupils unable to develop higher order thinking skills especially applying and analysing skills. Although pupils gained knowledge in learning process, they did not know how to practice it in a new situation. They tend to memorise facts and answer the closed ended questions. Moreover, group members were seen to be unable to contribute related information on the topics during unstructured group discussion. The ways of pupils asking questions was not helpful for them to discover new understanding in group discussion. By just applying Jigsaw Cooperative Learning was not enough, pupils' discussion was also inefficient without a well-planned communication.

In this study, Jigsaw Cooperative Approach was hypothesised to positively influence the development of pupils' higher order thinking skills especially applying

skill and analysing skill as compared to the use of conventional teaching. Teacher applied Jigsaw Cooperative Approach which involved the Jigsaw Cooperative Learning with Socratic Questioning. Teacher cannot simply use Jigsaw Cooperative Approach without training pupils on how to ask appropriate questions. The advantage of this study was that the behaviour among pupils will be influenced by the principles of cooperative learning. With the training, pupils can construct suitable questions that can potentially eliminate their misunderstanding and obtain the appropriate knowledge. Through the conversation and promoting questions, pupils will brain storm together and get the extra verbalised information. Good questions also promote thoughtful and relevant responses .

In the process of applying Jigsaw Cooperative Approach, pupils were interdependent to succeed. This learning was pupils centred where pupils involved actively and contributed to their group. Pupils asked Socratic questions to promote thoughtful and relevant responses. Pupils implemented applying skill and analysing skill in the process of teaching and learning new information from each other. They learned and worked together in groups and then combined the information into whole. This showed that pupils' applying skill and analysing skill had been developed.

Refer to the Figure 2.2, pupil was the input and through the teaching and learning approach, the pupil underwent desirable changes. The development of higher order thinking especially applying skill and analysing skill of the pupil was the output which provided feedback about the teaching and learning approach. Hence, through the manipulation of the teaching-learning approach by adopting Jigsaw Cooperative Approach, it was possible to produce desirable output.

2.8 Summary

This chapter described the review of the past studies about cooperative learning, Jigsaw Cooperative Learning, higher order thinking skills, Socratic Questionings and methodologies. Theoretical framework and conceptual framework were also discussed. In the next chapter, research methodology would be explained in detail.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter begins with research design of this study, sample of the study, instruments and the procedure of the study. The instruments' validity and reliability and the data analysis will be discussed.

3.2 Research Design

This study was a quasi-experimental research design where the samples were not randomly assigned. It involved pupils in two intact classrooms. However, the classrooms were randomly selected as experimental or control. The pupils in the first classroom were considered as experimental group and the pupils in the second classroom were considered as control group.

There were two teachers who taught the control and experimental groups separately. To control the teacher effects, two teachers had similar teaching background. Their major option in teaching was Science Education. They had ten years' experience in teaching Science. Researcher assisted the teacher who was teaching in experimental group to ensure that the teaching and learning would be carried out according to the lesson plans. Two topics had been chosen for the intervention, "The Earth, the Moon and the Sun" and "Technology". In the experimental group, Jigsaw Cooperative Approach had been carried out whereas conventional teaching was carried out among the pupils in the control group.

3.3 Sample of the Study

The sample for this study was Year Five pupils. Convenient sampling was done as the participating pupils were from the same school as the researcher. Convenient

sample had been used because the pupils in this school were the easiest to recruit for the study. These pupils were 11 years old and were studying in a Chinese national-type primary school in Pahang. These pupils were being taught Science using Mandarin. Two intact classes which comprised of 70 pupils were selected. There were 34 pupils in the control group and 36 pupils in the experimental group. In the experimental group, the pupils were divided into six groups. Each group was heterogeneous in terms of academic achievement. Pupils' academic achievement in each group were identical where two pupils were good, two pupils were moderate and two pupils were weak in academic learning.

Besides, Group 1 had been chosen randomly among six groups as the target group during observation. There were six pupils in group 1 who were being given the pseudonym. Chong and Tan were good academic achievers. They always understand information taught by teachers. Ling and Liew were moderate academic achievers. Ling always learn and listen the teaching but Liew was bad tempered. Meanwhile, Jayson and Jun Yi were weak academic achievers. They always keep quiet and do not give any responses.

3.4 Data Collection Technique

Three instruments had been used in this study. These included Science Academic Achievement Test, observation and questionnaire.

3.4.1 Science Academic Achievement Test

To investigate the effects of Jigsaw Cooperative Approach on HOTS among Year Five pupils, Science Academic Achievement Test (Appendix E) with higher order thinking questions which involved applying and analysing skills was carried out. There were two cycles in this study, Cycle I and Cycle II. In the First cycle, pupils learned the topic of "The Earth, the Moon and the Sun". Hence, Science

Academic Achievement Test I which included the questions of the topic of "The Earth, the Moon and the Sun" was carried out twice among the pupils, there were pre-test and post-test. In the Second cycle, pupils in the experimental group and the control group learned the topic of "Technology". Hence, Science Academic Achievement Test II which included the questions of the topic of "Technology" was also carried out twice among the pupils, there were pre-test and post-test.

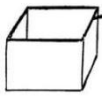
In each test, there were two sections, Section A and Section B. Questions in each test were separated in these two sections was to test the pupils by using different kind of questions. For the topic of "The Earth, the Moon and the Sun", there were 6 objective questions in section A and 5 short answers questions (with sub questions) in section B. In section A, pupils to choose the correct answer from four multiple choices in each question. In section B, pupils to answer the questions according to the situation given. Some of the questions were interrelated such as "Explain the changes of the length of the shadow throughout the day" and to make an inference based on the answer just now. In this test, there were 12 questions for testing applying skill and 13 questions for testing analysing skills.

For the topic of "Technology", there were 5 objective questions and 3 open-ended questions in section A while 4 short answers questions (with sub questions) in section B. In section A, the pupils had to choose the correct answer from four multiple choices in objective questions. For the open-ended questions, the pupils to write their explanation on why they chose the answer from four four multiple choices. This was to test their analysing skill. In section B, the pupils to answer the questions according to the situation given. Some of the questions were interrelated such as "From the fastest to the slowest, predict the order in which the model falls" and to make an inference. In this test, there were 11 questions for testing applying skill and

14 questions for testing analysing skill. The questions in the pre-test and post-test were same but different in order arrangement. This was to avoid memorisation of the answers through the pre-test. All the questions in each topic was worth 50 marks and the total marks for both topics would be 100. Table 3.1 showed the examples of questions for applying skill and analysing skill in the Science Academic Achievement Test.

Table 3.1

Examples of Questions for Applying Skill and Analysing Skill

<table>
<tr><th>Skills</th><th>Questions</th></tr>
<tr><td>Applying skill</td><td>3a. Diagram 2 shows a carton. (Applying)
 
Diagram 2

Choose the most suitable way to increase the strength of the carton.
A increase the height of the carton
B reduce the height of the carton
C use the corrugated cardboard to make the cartoon
D increase the base area of the carton</td></tr>
<tr><td>Analysing skill</td><td>1.Which statements about the rotation and revolution of the earth are correct?
<table><tr><th></th><th>Rotation of the earth</th><th>Revolution of the earth</th></tr><tr><td>A</td><td>Rotate from west to east</td><td>Revolve from east to west</td></tr><tr><td>B</td><td>Spend 24 hours</td><td>Spend 365 ¼ days</td></tr><tr><td>C</td><td>Cause the formation of day and night</td><td>Change the position of the shadow</td></tr><tr><td>D</td><td>The moon rotates around the earth</td><td>The earth revolves around the moon</td></tr></table></td></tr>
</table>

According to Table 3.1, pupils needed to apply their knowledge on the shapes of the structure in order to answer the question related to applying skill. The pupils learned the reason how corrugated shape could be strengthen and applied it to the inner layer of carton. For the question on analysing skill, firstly the pupils needed to

understand the differences between rotation and revolution of the Earth. Then, they could analyse and differentiate the characteristics of the rotation and revolution of the Earth.

For the Science Academic Achievement Test (Appendix E), the questions that were related to the two topics which involved applying and analysing skills had been chosen from different Science workbooks. The researcher had chosen the topical questions in the workbooks based on the content knowledge in the Science textbook and related to the Science syllabus. The researcher also distinguished the questions for testing applying skill and analysing skill by reading and identifying the keywords in the questions.

To test the content validity, all the questions in the Science Academic Achievement Test were validated by a lecturer and three science teachers. The lecturer taught Science Education in a university and the three science teachers were teaching Science for more than twenty years in Chinese national-type primary schools. After the selection of questions, the researcher discussed with them and received some feedback. The researcher decided to make some changes according to the feedback given by the lecturer and science teachers to further promote applying and analysing skill through the Science questions.

Table 3.2

The Modified Questions in Science Academic Achievement Test

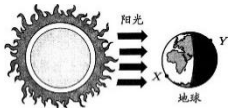
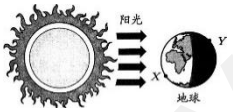
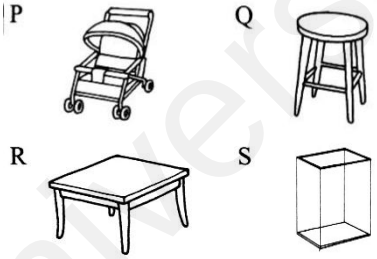
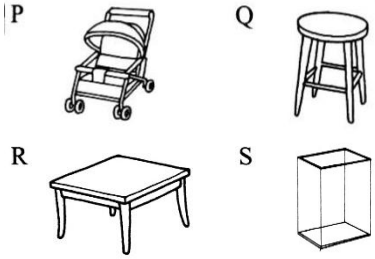
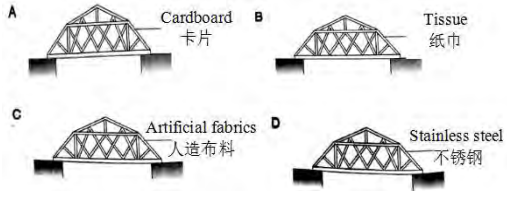
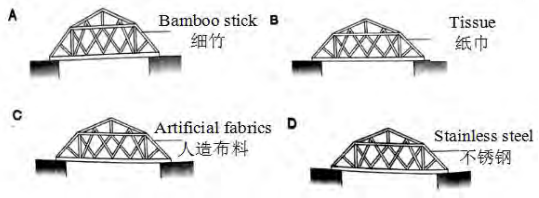
Original questions	Modified questions
Science Academic Achievement Test I	
Section B 1b.Explain the changes in the length of the shadow from morning to noon. (Applying)	Section B 1b.Explain the changes in the length of the shadow throughout the day. (Applying)
5.Diagram 8 shows two areas, X and Y.  Diagram 8 Based on the diagram, which area undergo daytime? (Analysing)	5.Diagram 8 shows two areas, X and Y.  Diagram 8 Area X and Y won't exist day and night at the same time. Why? (Analysing)
Science Academic Achievement Test II	
Section A 2.The following pictures show the common objects in daily life. (Applying)  Which of the object is the most unstable? A P B Q C R D S	Section A 2.The following pictures show the common objects in daily life. (Applying)  Which of the object is the most unstable? A P B Q C R D S 3.Based on the answer in question 2, give your explanation. (Analysing)
4.Jenny created four bridge models with different materials. Which bridge model is the most firm? (Applying)  	4.Jenny created four bridge models with different materials. Which bridge model is the most firm? (Applying) 

Table 3.2 showed the modified questions in the Science Academic Achievement Test. The science teachers suggested that in the Science Academic Achievement Test I, question no.1b in Section B should change the title "Explain the changes in the length of the shadow from morning to noon" to "Explain the changes in the length of the shadow throughout the day." This was because the modified question was more complete to test the pupils' knowledge on the overall concept of the shadow length.

They also suggested to make changes for the question no.5 in Section B. Since question no. 6 in Section A already tested the pupils to analyse which part of the earth undergo day or night, then question no. 5 in Section B can ask the reason of why day and night cannot exist at the same time. Hence, repeated similar questions could be avoided.

For the Science Academic Achievement Test II, they had also provided some feedback. For Section A, they had suggested to let the pupils to state their reason why they chose the particular answer out of the four multiple choices. Hence, after the question no.2, 4 and 6, an open-ended question was added to request the pupils to provide their explanation in accordance to the answer chosen.

For the question no.4 in Section A, teachers suggested to change the bridge material from cardboard to bamboo sticks to distinct the material difference. This was because both cardboard and tissue were made from the same material, i.e. pulp (wood fibre). However, bamboo was a different material as compared the other three bridge models. So, the pupils needed to differentiate the characteristic of each material and apply the applying skill in this situation.

3.4.2 Observation

During the course of treatment, observation was carried out in the Cycle I and the Cycle II. In this study, the observation was overt, where the pupils knew they were being observed. Before the observation, teacher informed the pupils that the group discussion will be audio recorded and the data that had been recorded were confidential and just for research purpose. During the observation, the researcher acted as a non-participating observer. Since the researcher only wanted to observe the pupils' cooperative skills when Jigsaw Cooperative Approach was implemented, the researcher was going to choose one group among six groups and assumed that all groups were similar. The researcher decided by lot among six groups and group 1 had been chosen as the target group by using random sampling among six groups. During the observation, the researcher sat behind the classroom and observed the learning process of Group 1. Observation was carried out during information sharing in home group and the process of working for a group task in home group. The group discussion in the expert group was not being observed because the pupils were merely sharing different subtopics in home group. The observation took 40 minutes for each information sharing and group task working session. The researcher stayed around Group 1, based on the observation protocol, observed the pupils and recorded the pupils' performance in the observation remarks. Researcher also recorded the field notes.

To investigate the pupils' cooperative skills, observation protocol had been prepared according to the two elements of cooperative learning stated by Johnson and Johnson (1999), there were positive interdependence and face-to-face interaction. As the pupils spent a lot of time to realise their own misunderstanding by their own and did not know how to cooperate with each other to finish the group tasks, these

two elements of cooperative learning had been focused. The pupils were given the opportunity to contribute their knowledge, assigned works and learned to depend on each other to complete the group task within the time given. They also learned to encourage each other, shared ideas in groups and helped each other together with their group members.

In the observation protocol (Appendix F), the pupils' performance had been listed according to these two basic elements of cooperative learning. To prepare the observation protocol, the researcher referred to the main ideas of these elements of the cooperative learning. For example, to check whether the pupils were positive interdependence, the pupils should involve themselves in group activities such as playing the role of a leader and a learner, concerning about group members, listened and accepting the opinion from each other and etc. To investigate the face-to-face interaction among the pupils, their performance such as helping their group members in group works, giving encouragement and sharing ideas by carrying out question and answer session were being observed.

Then, the researcher showed the observation protocol to the lecturer and a science expert who have at least ten years' experience in Science Education and studied for cooperative learning. After the discussion with the lecturer and science expert, they had provided some feedback for the observation protocol. The researcher had made some changes according to the feedback. They suggested to write the guideline for each criteria of cooperative learning in detail. They had also suggested to list out the observable actions by providing some examples under each criteria.

The researcher listed out the categories for each element. For example, under the Positive Interdependence, there were two categories, Dependent on Each Other and Complement with Others. Then, under each category, the researcher listed out

the observable actions and provided some examples for reference. The researcher wrote some remarks and field notes based on the guidelines provided during observation.

Table 3.3

Modified Observation Protocol

Criteria	Guidelines	Researcher Observation / Remarks
Positive Interdependence	2.Complement with others a. willing to learn from each other (ex: ask their group members when they do not understand) b. willing to teach each other (ex: answer the questions asked by the group members) c. concern with those who are not confidence (ex:listen to the opinion of each other) d. accept the suggestion of each other politely (ex: explain the reason patiently if do not agree with the suggestion) e. assign task and divide job	

Table 3.3 showed the example of modified guidelines under the category of Complement with Others. If the pupils ask their group members when they do not understand, this showed that the pupils are willing to learn from each other. This showed that the positive interdependence existed among group members. After the discussion and some changes made, they agreed with the content of the observation protocol.

The researcher observed the pupils according to the observation protocol. The researcher focused on the involvement of group members in activities and interactions that occurred in home group. The researcher observed and recorded the pupils' behaviour such as the pupils' participation during discussion, the pupils' involvement in group activities and the pupils' communication by asking and

answering the questions. The researcher only observed the pupils' cooperative skill during information sharing and working for a group task because these two processes occurred in home group. The pupils communicated with their group members most of the time during these two processes.

During information sharing session with the home group members, the pupils took turn to teach and to learn the subtopics from each other by carrying out experiments, activities, group discussion and explanation. Then, the pupils made conclusion and organised what had been learned into a mind map. The researcher observed how the pupils applied what they had learned in the expert group to teach their home group members and to analyse the information that was learned from the other group members.

After sharing information in the home group, the pupils worked for a group task. They carried out group work and presented the products that they made. The researcher observed how the pupils cooperated to achieve goals and implemented applying and analysing skills in this step. In these two steps, the pupils collaborated and communicated with their group members to learn new knowledge, solve problems and make decisions. For instance, if a pupil asked questions and the group members are willing to answer the questions, this could be deduced that they are interdependence with each other and willing to teach each other.

3.4.3 Jigsaw Cooperative Approach Questionnaire

After intervention, teacher distributed questionnaire (Appendix H) to the experimental group pupils to measure pupils' perceptions on Jigsaw Cooperative Approach. The statements in the questionnaire adapted from previous research related to perceptions of the pupils on cooperative learning (Wichadee, 2005). There were 15 statements in questionnaire. By referring the questionnaire, statement no.1 to

no.5 were related to the Year 5 pupils' academic learning after applying Jigsaw Cooperative Approach, statement no.6 to no.10 were related to the cooperation among pupils after applying Jigsaw Cooperative Approach whereas statement no.11 to no.15 were related to the mastering of applying skill and analysing skill after the Jigsaw Cooperative Approach was carried out. The pupils used five Likert scale to rate their perceptions on the Jigsaw Cooperative Approach as a Science learning method in questionnaire.

The questionnaire in English version had been translated into Mandarin and checked by the three experienced science teachers in schools and validated by a language expert. The language expert had made sure the content of the questionnaire in the English version and the Mandarin version were the same. To ensure the content validity, the researcher had discussed the content of the questionnaire with the university lecturer and the science expert to make sure the statements in the questionnaire were related to this study.

For the questionnaire (Appendix H), the original questionnaire consisted of ten statements which is made for first year university pupils. To ensure the statements were clear and suited to primary pupils, some structures of the statements had been modified. Table 3.4 and Table 3.5 had shown the modified and new developed statements in the questionnaire after incorporated the feedback from the lecturer and the science expert. The teacher in the experimental group also played the facilitator role to explain the meaning of the statements to those who did not understand but it did not influence their choices.

Table 3.4

The Modified Statements in Questionnaire

Original Statements	Modified Statements
3. This approach makes me understand the working process.	3. This approach makes me understand my work because my friends explain them well.
5. This approach helps everyone reach the goal equally.	4. This approach helps everyone achieve the objectives.
4.This approach enables me to participate in sharing information, making decisions, and solving problems.	6.Through this approach, I like to share my knowledge with my friends.
10. I feel intellectually challenged through this approach.	5. I feel happy to learn Science through this approach.
6. This approach trains me how to be a good leader and a good follower.	7. This approach trains me listen better to what my friends say.

After discussing with the lecturer and the science expert, they had provided some feedback. They mentioned that some statements in the questionnaire should be modified so that the primary school pupils could better understand the statements according to their level. According to Table 3.4, a total of five statements in the original questionnaire were modified. For example, the third statement "This approach makes me understand the working process." had been modified to "This approach makes me understand my work because my friends explain them well". This also showed when "This approach trains me how to be a good leader and a good follower" had been modified to "This approach trains me listen better to what my friends say". According to the science expert, the statements should be changed because pupils assisted each other in the learning process through Jigsaw Cooperative Approach in this study. It was more important to know whether they can learn from each other rather than understand the working process.

Some statements in the questionnaire had been modified because it was more effective to measure one idea in one statement. Hence, "This approach enables me to participate in sharing information, making decisions, and solving problems" had been modified to "Through this approach, I like to share my knowledge with my friends". The adjustment of the sequence of the statements also had been done because the statements can be grouped together to analyse the pupils' perception in several aspects.

Table 3.5

The Developed Statements in the Questionnaire

	Added Statements
11.	This approach helps me to organise the content of the topic.
12.	This approach helps me to solve problems by applying knowledge in the situation.
13.	This approach helps me to relate the knowledge that I learned with my daily life.
14.	This approach enable me to implement the knowledge that I learned to finish the task given.
15.	This approach enable me to ask questions in different ways when I am not understand the meaning.

Furthermore, the lecturer and science expert also found that it was important to understand the pupils' perceptions on Jigsaw Cooperative Approach in mastering of applying skill and analysing skill. The keywords for these two skills be used to develop the new statements in the questionnaire. Hence, statement no.11 to no.15 were being added in this modified questionnaire as shown in Table 3.5.

3.5 Pilot Study

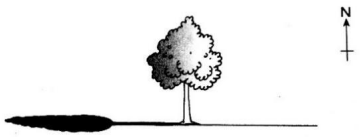
Pilot study is a small scale study which is conducted before the real research is carried out (Chua, 2013). Pilot study had been carried out to examine the reliability of the pre-test, post-test and questionnaire developed by the researcher in this study. A total of 30 pupils that have similar characteristics as those who will participate in the actual research were selected to carry out the pilot study. Through pilot study, the

researcher identified whether the questions in the Science Academic Achievement Test and the statements in the questionnaire would be confusing to or difficult to the pupils.

Before pilot study is being carrying out, the researcher discussed with the pupils and asked them to underline the words that they don't know in the Science Academic Achievement Test and questionnaire. Then, the researcher discussed with the science teachers and the lecturer to make some changes to the terminologies and the sentence structure for easier understanding.

Table 3.6

The Modified Questions in Science Academic Achievement Test Before Pilot Study

Original questions	Modified questions
Science Academic Achievement Test I	
Section B: 2.Diagram 6 shows a tree and its shadow.  Diagram 6	Section B: 2.Diagram 6 shows a tree and its shadow.  Diagram 6
a. Predict the length and position of the tree's shadow after four hours. (Applying) i. The length of the tree's shadow: ___ ii. The direction of the tree's shadow: ___	a. Predict the length and position of the tree's shadow after four hours. (Applying) i. The length of the tree's shadow: (long / short) ii. The direction of the tree's shadow: (middle/ east/ west)
Science Academic Achievement Test II	
4a.According to Diagram 8, answer the questions.  Diagram 8 Which building will you feel safe to live in? (Applying)	4.a.According to Diagram 8, answer the questions.  Diagram 8 If storm occurred, which building will you feel safe to live in? (Applying)

For example, the pupils had stated that they did not know what answer to be filled in for the question no.2ai in Section B for Science Academic Achievement Test I. They were not sure whether they need to measure the exact length of the shadow or just provide general answer such as long or short. Hence, the researcher had made changes and provided two choices of answers for this question. Furthermore, the pupils had also given comments on question no.4a in Section B for Science Academic Achievement Test II. They had found that Building X and Building Y were safe for them to live in. So, after discussion with the lecturer and the science teachers, we had mutually decided to add a situation into this question. The question had been modified to "If storm occurred, which building will you feel safe to live in?". Hence, the question is clearer for the pupils. Besides that, the pupils had no comments on the questionnaire, hence no changes made after the pupils had read it.

Thereafter, the teacher carried out pilot study. The teacher had conducted pre-test and the post-test was given for the second time after one week. The teacher had also distributed the questionnaire after the post-test was carried out. The data for the pilot study had been collected and analysed to examine the reliability of the test and questionnaire. The findings of the pilot study will be discussed in section 3.6 as below.

3.6 Reliability of the Science Academic Achievement Test and Questionnaire

Chua (2013) stated that reliability referred to the ability of a study or research to obtain similar values when the same measurement was repeated. In this study, pilot study had been carried out to obtain the reliability of the Science Academic Achievement Test and questionnaire. Test-retest reliability method had been used to test the reliability of the pre-test and post-test. The research instrument was reported to be reliable when the correlation value (r) is .65 and above (Chua, 2013). Pilot

study had been carried out on 30 pupils who have similar characteristics with the subjects in this research. The Pearson correlation test results showed that for this group of subjects(n=30), the test-retest correlation values for the applying and analysing skills were .84 and .85 respectively, which was significant at the significant level of $p<.01$. This indicated that the test was suitable for obtaining reliable data from other samples that have the same characteristics as this group of pilot study.

The instrument's reliability was referred to the Cronbach's alpha reliability method. The alpha value of .65 to .95 is considered satisfactory (Chua, 2013). The questionnaire used in this study was adapted from Wichadee (2005). This questionnaire had also been used by Nejad and Keshavarz in their study in Year 2015. Referring to the findings of the pilot study analysis that had been conducted, the Cronbach's Alpha value for the questionnaire was .75, which showed that the items in the questionnaire had average reliability to measure the perceptions of the pupils on Jigsaw Cooperative Approach. After the pilot study, the researcher had realised that the teacher was important role to make sure pupils answered the questionnaire seriously and proceed the statements one by one.

3.7 Intervention

The pupils from both groups were being taught the topics of "The Earth, the Moon and the Sun" and "Technology" by using different instructional approaches. In the experimental group, the teacher taught by using Jigsaw Cooperative Approach whereas in the control group, the teacher taught by using conventional teaching. The same content would be taught in both groups by different teachers but the learning standards were the same. Before the intervention, the researcher had trained the experimental group's teacher and carried out the training in the classroom for three

weeks. The teacher in the experimental group had learned how to implement Jigsaw Cooperative Approach which included Jigsaw Cooperative Learning and the way to promote Socratic questions. Both teachers in the experimental group and the control group had carried out the teaching and learning process according to the lesson plans after the training had been completed.

3.7.1 Training for Jigsaw Cooperative Approach

The researcher had introduced Socratic questions to the teacher in the experimental group based on the information on Socratic Questioning by referring to the notes of various types of Socratic questions. Socratic Questioning that draw from Richard Paul in 1998 have six types of Socratic questions. This had been shown in Table 3.7. The researcher explained each type of the questions to the teacher and gave some examples for each type of questions. The teacher had also learned how to differentiate each type of Socratic questions with the researcher and practised the way to promote Socratic questions with the researcher.

Table 3.7

Six Types of Socratic Questions

1.	Questions for clarification:	-Why do you say that? -How does water relate to energy?
2.	Questions that probe assumptions:	-How can you verify or disapprove that assumption? -How can you verify or disapprove that water can replace the role of petrol for vehicles?
3.	Questions that probe reasons and evidence:	-What do you think causes to happen...? Why? -Do you think that wind is suitable to be used as a source of energy for our country?
4.	Questions about Viewpoints and Perspectives:	-What is another way to look at it? -How are biomass and food similar?
5.	Questions that probe implications and consequences:	-What are the consequences of that assumption? -How does nuclear energy affect the human life?
6.	Questions about the question:	-What was the point of this question? -Do you think renewable energy is important?

Then, the researcher explained the way of carrying out Jigsaw Cooperative Learning to the teacher in the experimental group. First, the pupils were divided into six heterogeneous groups which called home groups. Then, the teacher divided the notes of the subtopics to the pupils. The pupils read and understood the notes and the teacher acted as a facilitator to explain the meaning of the terminologies in case the pupils cannot understand. After that, the pupils were grouped into expert groups according to their subtopics. The pupils carried out the activities or experiments to understand the content of the subtopics and the teacher walked around to guide the pupils to carry out activities. For instance, the teacher had reminded the pupils to set up the model of the experiment properly to ensure that they can get the exact results. After the discussion in the expert group, the pupils returned to their home groups and started the information sharing process. The teacher made sure the pupils took turn to share the content of the subtopics. If the pupils just kept quiet, the teacher prompted with questions and encouraged them to share the information of the subtopics together. For example, the teacher asked the pupils "Do you agree with the suggestion of your friends? Why?" to arouse their interest in the discussion. The teacher also encouraged the pupils by praising them with "Well done! I agreed with you! Can you explain it by giving an example?" Then, the teacher observed how the pupils carried out discussion. The teacher did not make decision for the pupils but invited the group members to share their opinions and suggestions. Lastly, the teacher had reflection session with the pupils.

After training the teacher with the ways to ask Socratic questions and to carry out Jigsaw Cooperative Approach, the teacher conducted the training sessions for teaching the topic of "Energy" by using Jigsaw Cooperative Approach to practice the techniques that was learned with the assistance of the researcher. Table 3.7 showed

some Socratic questions that had been asked during the teaching of topic "Energy" in the training.

In the training, the teacher distributed the notes of Socratic questions to the pupils. The teacher explained the usage of each type of questions and showed some examples of questions. Then, the teacher demonstrated how to pose the questions and guides the pupils to pose questions according to Socratic style of Questioning in group discussion which might arouse their thinking. For example, when a pupil doesn't understand the suggestions from his group members, he can pose questions for clarification such as "Why do you say that?" or "Can you explain further?" to help him understand better.

The pupils practised Socratic questions during the implementation of Jigsaw Cooperative Approach. First, the pupils tried to understand each type of questions based on the notes given and grouped the questions to make sure they are able to differentiate each type of questions. Then, they sat in groups to practice Socratic questions such as asking questions which focus attention on a specific problem. They reminded each other when their group members were unable to promote questions in the discussion. These processes were repeated to ensure the pupils are familiar with the Socratic questions and to sharpen their ability to think clearly, critically and reflectively.

After three weeks of the training, the researcher and the teacher reflected and discussed together on how to encourage pupils to cooperate and to solve problems encountered when pupils promote Socratic questions in groups.

3.7.2 Procedure of Jigsaw Cooperative Approach

Table 3.8 showed the comparison of the time line for the lesson plans between experimental group and control group. Jigsaw Cooperative Approach had

been carried out in the experimental group whereas conventional teaching had been carried out in the control group. Each topic took about four weeks. There were four Science lessons in each week and each lesson was 30 minutes.

Table 3.8

Time line of the Research

Experimental Group	Time	Control Group
First cycle Topic "The Earth, the Moon and the Sun"		
-pre-test -Introduction and setting ground rules -Carried out Jigsaw Cooperative Approach i. Orientation ii. Elicitation of ideas using Socratic questions iii. Studied information in the home group	First week	-pre-test -Introduced the topic and subtopics -taught the subtopic of 1.Rotation and Revolution of the Earth
iv. Discussed and learned the subtopics in expert group v. Shared information in home group	Second week	-taught the subtopics of 2.The Formation of Day and Night and 3.Position of the Sun and How the length of the Shadow Changes?
v. Shared information in home group (continued) vi. Worked for a group task	Third week	-taught the subtopics of 4.How the Position of the Shadow Changes? 5.Rotation and Revolution of the Moon
vi. Worked for a group task (continued) vii. Conclusion -post-test	Forth week	-taught the subtopic of 6.Moon Phase -Teacher summarised the lesson for this topic. -post-test

Table 3.8, (continued)

Experimental Group	Time	Control Group
	Second cycle Topic "Technology"	
-pre-test -Introduction -Carried out Jigsaw Cooperative Approach i. Orientation ii. Elicitation of ideas using Socratic questions iii. Studied information in the home group	Fifth week	-pre-test -Introduced the topic and subtopics -taught the subtopic of 1.Shape of the Objects
iv. Discussed and learned the subtopics in expert group v. Shared information in home group	Sixth week	-taught the subtopics of 2.Base Area Affect Stability of the Objects 3.Height Affect Stability of the Objects
v. Shared information in home group (continued) vi. Worked for a group task	Seventh week	-taught the subtopics of 4.Type of Materials Used Affect Strength of the Objects 5.The Way a Structure Placed Affect the Strength of the Objects
vi. Worked for a group task (continued) vii. Conclusion -post-test -Questionnaire	Eighth week	-taught the subtopic of 6.How to Practice Sustainable Use of Materials -Teacher summarised the lesson for this topic. -post-test

Table 3.9 showed the details for the procedure of carrying out Jigsaw Cooperative Approach in the experimental group.

Table 3.9

Procedure of Jigsaw Cooperative Approach in Experimental Group

Time	Procedure of Jigsaw Cooperative Approach
	First cycle Topic "The Earth, the Moon and the Sun"
First week (2 hours)	-pre-test (1 hour) -introduction and set ground rules i. Set induction (5 minutes) ii. Elicitation of idea (25 minutes) -Teacher posed Socratic questions to arouse pupils' interests and identify their previous knowledge. iii. The pupils divided into group of six (home group), assigned the subtopics and studied the information. (30 minutes)

Table 3.9, (continued)

Time	Procedure of Jigsaw Cooperative Approach
Second week (2 hours)	iv. The pupils moved into expert group, carried out activities and discussed the information by asking Socratic questions. (30 minutes) v. Sharing Information in Home Group (90 minutes) -The pupils backed to their home group and shared information. -In home group, each group members explained their subtopics by carrying out suitable activities. -During discussion, group members were encouraged to ask Socratic questions for further understanding. -The pupils organised information by using mind map. (applying skill and analysing skill) -Observation carried out by researcher.
Third week (2 hours)	v. (Continued)Sharing Information in Home Group (60 minutes) vi. Working for a Group Task (60 minutes) -The pupils prepared a product that relate to the topic. -Observation carried out by researcher.
Fourth week (2 hours)	vi. (Continued)Working for a Group Task (50 minutes) -The pupils carried out "1 stay 5 stray" by explaining their products to other pupils. (applying skill and analysing skill) vii. Conclusion (10 minutes) -carried out post-test (1 hour)
	Second cycle Topic "Technology"
Fifth week (2 hours)	-pre-test (1 hour) -introduction and set ground rules i. Set induction (5 minutes) ii. Elicitation of idea (25 minutes) -Teacher posed Socratic questions to arouse pupils' interests and identify their previous knowledge. iii. The pupils divided into group of six (home group), assigned the subtopics and studied the information. (30 minutes)
Sixth week (2 hours)	iv. The pupils moved into expert group, carried out activities and discussed the information by asking Socratic questions. (30 minutes) v. Sharing Information in Home Group (90 minutes) -The pupils backed to their home group and shared information. -In home group, each group members explained their subtopics by carrying out suitable activities. -During discussion, group members were encouraged to ask Socratic questions for further understanding. -The pupils organised information by using mind map. (applying skill and analysing skill) -Observation carried out by researcher.
Seventh week (2 hours)	v.(Continued)Sharing Information in Home Group (60 minutes) vi. Working for a Group Task (60 minutes) -The pupils prepared a product that relate to the topic. -Observation carried out by researcher.

Table 3.9, (continued)

Time	Procedure of Jigsaw Cooperative Approach
Eighth week (2 hours)	vi.(Continued)Working for a Group Task (50 minutes) -The pupils carried out presentation by explaining their house model to other pupils. (applying skill and analysing skill) vii. Conclusion (10 minutes) -carried out post-test (1 hour) and questionnaire

According to the Table 3.9, pre-test was carried out before the learning starts. It took one hour to carry out pre-test. After that, introduction of Jigsaw Cooperative Approach was carried out. Before the intervention, the teacher explained the learning standards of the topics to make sure pupils had an overall ideas on the topics that would be learned by using Jigsaw Cooperative Approach. The teacher also explained the Jigsaw Cooperative Approach, roles of group members and assessment to the pupils. The teacher had explained what is the pupils' roles in the expert group and the home group to enable each pupil realised how important they were in groups. Specific ground rules were set together among pupils. These ground rules included sharing all relevant information; learning to listen the ideas from each other; providing reasons; seeking to reach consensus; discussing together before making a decision; accepting the group decisions and encouraging each group member to speak.

Then, the teacher carried out Jigsaw Cooperative Approach as intervention according to the lesson plans (Appendix C). After induction, the teacher asked Socratic questions to elicit the pupils' idea on the Science topic. Then, the pupils in experimental group were divided into six heterogeneous groups called "home group". Each pupil in the home group was assigned with a subtopic. They moved to the expert group which studied the same subtopic. They started to learn and to discuss the materials in the groups. When they returned to the home group, the researcher started to observe the pupils and assess their interactions based on the observation

protocol. The researcher had also used a tape recorder to record the pupils' group discussion. In the home group, the pupils taught the subtopics that had been learned in the expert group to their group members. They also learned other subtopics from their group members. They were encouraged to ask Socratic questions during information sharing to stimulate deep thinking on the topics. They also organised the information by using mind map, it can be the notes for this Science topic.

They were also given a group task and cooperated to complete the group task. In the process of information sharing and working for a group task, their cooperation had been closely observed by the researcher. After intervention, post-test took an hour and these procedures was repeated in the Second cycle. The questionnaire session of 30 minutes was carried out after the Second cycle of intervention.

3.7.3 Procedure of Conventional Teaching

Refer to Table 3.8, the topic of "The Earth, the Moon and the Sun" and "Technology" was taught by the teacher using conventional teaching method in the control group (Appendix D). During conventional teaching, the pupils carried out the pre-test before the lesson for each topic started. After that, the teacher taught the information of the topic to the pupils. The pupils referred the information in the Science text book and the teacher led the pupils to read and to understand the information by asking questions. The teacher also guided pupils to carry out the activities in the text book. The pupils took notes according to each subtopic in the learning process and did the exercises in the activity books and topical exercises. The teacher discussed the answers and asked the pupils to make correction in their exercise book. Thereafter, the teacher summarised the lesson for this topic and pupils answered the questions in the post-test. It took about 4 weeks to cover each topic.

In the first week, the teacher carried out the pre-test and taught the subtopic of "Rotation and Revolution of the Earth". In Week 2, the subtopics of "The Formation of Day and Night and Position of the Sun" and "How the length of the Shadow Changes?" had been taught. The subtopics of "How the Position of the Shadow Changes?" and "Rotation and Revolution of the Moon" had been taught in Week 3. In Week 4, the teacher taught the subtopic of "Moon Phase" and then carried out the post-test.

The procedures of the study would be repeated for the teaching on topic of "Technology" in the Second cycle. In Week 5, the pre-test of this topic had been carried out and the subtopic of "Shape of the Objects" had been taught. In Week 6, the subtopics of "Base Area Affect Stability of the Objects" and "Height Affect Stability of the Objects" had been taught. The subtopic of "Type of Materials Used Affect Strength of the Objects" and "The Way a Structure Placed Affect the Strength of the Objects" had been taught in Week 7. In Week 8, the subtopic of "How to Practice Sustainable Use of Materials" had been taught and the post-test had been carried out.

3.8 Analysis of the Data

The data collected through different instruments were be analysed. The quantitative data included the results of Science Academic Achievement Test and the data was collected by using questionnaire. The qualitative data included the observation of the pupils' cooperative skills during the group activities.

3.8.1 Science Academic Achievement Test

To investigate the effect of Jigsaw Cooperative Approach on Year Five pupils' applying and analysing skill, pre-test was carried out before the intervention and the post-test was carried out after the intervention. After collecting the pre-test

data, the data was analysed to find out whether there have differences between pupils in experimental group and control group. After that, pre-test and post-test scores of both groups were analysed by using Independent T-test through SPSS 20.0. The difference between pre-test and post-test of the experimental group and the control group were analysed by using Paired-samples T-test. Subsequently, how Jigsaw Cooperative Approach brought effects on pupils' higher order thinking skills in terms of applying and analysing skills can be identified.

3.8.2 Data of the Observation

The pupils' cooperative skills during Jigsaw Cooperative Approach were observed by the researcher. The data collected from observation remarks, field notes and audio recording were analysed, for audio recording it was transcribed then converted into text data. The text data were coded, grouped into themes and description. Then, the pupils' overall performance was also being evaluated by using rubric.

The Domain Analysis Method had been used where the raw data of observation was coded as sub themes or categories. The categories had been grouped into different themes and then themes grouped as a domain. It was used to analyse the pupils' cooperative skills in the group discussion. In this study, only two themes, Positive Interdependence and Face-to-Face Interaction were being observed and discussed.

For example, the pupils did not pay attention and did not assign jobs evenly during information sharing. This was coded as "Did Not Play Their Own Role". This shown that the pupils showed weak positive interdependence during information sharing. Other than that, the pupils took initiative in group works. This can be coded as "Involve Actively in Group Task". For example, when the teacher asked how to

make the product more interesting, Tan took initiative to share her ideas. Due to her interest, she took initiative and involved herself in group work. These codes were grouped under the theme of Positive Interdependence.

In addition, during working for a group task, group members worked together to build up the house model. They helped their group members to hold the sticks when the group members glued the sticks. This was coded as "Help on Each Other". The pupils also encouraged each other by giving motivation, supports and praise for the suggestion of their group members. This can be coded as "Encouragement". These codes were grouped under the theme of Face-to-face Interaction.

Furthermore, the researcher also evaluated the pupils' cooperative skills in the targeted group based on the rubric (Appendix G) in the Cycle I and the Cycle II. A rubric that was adapted from Chad Manis (2012) and modified according to the two elements of cooperative learning stated by Johnson and Johnson (1999) was used to assess the cooperative skills among Year Five pupils. In the process of modification, two categories in the original rubric had been chosen and arranged according to the criterion. The category of "Contribution to Group Goals" was used to evaluate the "Positive Interdependence" among pupils. There were several guidelines under this category, such as Depend on Each Other and Complement with Others. The category of "Working and Sharing with Others" was used to evaluate the "Face-to-Face Interaction" among pupils. The guidelines under this category included "Help on Each Other", "Encouragement" and "Share Ideas".

The original rubric used scale 1-4 to rate the performance of the pupils. The rubric was modified and contained four performance descriptors, these were excellent, good, moderate and weak. Scale 1 description was considered weak

performance, scale 2 description showed moderate performance, scale 3 description showed good performance and scale 4 description showed the excellent performance of the pupils. The modification had been carried out because these descriptors helped the observer to evaluate the cooperative skills of the pupils based on these two categories. It was meaningful to know the cooperation of group members with description and not just the total marks gained by the pupils.

The group performed excellent in cooperation when the pupils depended and complemented each other without prompting, actively worked towards group goals and willing to accept and play their roles within the group without prompting. The pupils also helped each other, encouraged each other and shared ideas together without any prompting.

The group that was said to be weak in performance was the group that seldom depend and complement each other even when prompted, seldom worked towards group goals and seldom accept and play their roles within the group even when prompted. They also seldom helped each other, encouraged each other and shared ideas together even when prompted. For example, the pupils still did not play their role as learners during information sharing although reminded numerous time by the teacher. Their performance of cooperative skills was considered weak.

3.8.3 Perceptions on Jigsaw Cooperative Approach

The researcher used the questionnaire to investigate the pupils' perceptions on Jigsaw Cooperative Approach. There were three aspects in the questionnaire, that were academic learning, cooperation and mastering of applying skill and analysing skill. Descriptive statistics was conducted to analyse the data of the questionnaire. The percentage and frequency of the perceptions score for the pupils in the experimental group were calculated. The mean, mode and median had also been

stated. The higher the percentage of the pupils' response, the more they agree with the statements. From the average mean, mode and median that we obtained from the data analysis, we identified that the whole sample response was more to agree or disagree with the statements. The questionnaire data was analysed by using SPSS 20.0.

3.9 Summary

This chapter had described the research design, sample of the study, instruments, pilot study, validity and reliability, procedure of carrying out Jigsaw Cooperative Approach and conventional teaching and the way to analyse data. In the following chapter, data analysis for the pre-test and post-test, observation and questionnaire will be discussed.

CHAPTER 4

FINDINGS

4.1 Introduction

The data collected which were Science Academic Achievement Test results, observation data and results of questionnaire. These data collected will be analysed and interpreted. The findings will be discussed in this chapter.

4.2 Analysis of the Science Academic Achievement Test Results

There were two different types of data collection methods had been used in this study. The first was quantitative method (Science Academic Achievement Test and results of questionnaire) and the second was qualitative method (classroom observation).

Science Academic Achievement Test with different Science topics' questions had been carried out twice in the experimental group and the control group in the Cycle I and the Cycle II, that were pre-test and post-test. The Science Academic Achievement Test I included the questions on the topic of "The Earth, the Moon and the Sun" in the Cycle I. In the Cycle II, the Science Academic Achievement Test II included the questions on the topic of "Technology". Pre-test had been carried out before the intervention was carried out whereas post-test had been carried out after the intervention was carried out.

Independent T-test had been used to analyse the pre-test scores between experimental group and control group and the post-test scores between experimental group and control group. Paired-samples T-test also had been carried out to determine if there is a difference between the mean scores of pre-test and post-test for experimental group and control group.

4.2.1 Independent Samples T-test Results for the Pre-test Scores between Experimental and Control Group

To carry out t-test, one of the requirements was the data in the population must be normally distributed. Below was the Normality Test results.

Table 4.1

Normality Test for Pre-test Scores in Experimental Group and Control Group

Group	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Experimental Group	.11	36	.20*	.97	36	.32
Control Group	.13	34	.20	.96	34	.18

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Normality test had been carried out. The data of the pre-test for the experimental group was normally distributed as the value of Kolmogorov-Smirnov and Shapiro-Wilk were .20 and .32 respectively, which showed that the test was insignificant (p>.05). The data of the pre-test for the control group was normally distributed as the value of Kolmogorov-Smirnov and Shapiro-Wilk were .20 and .18 respectively, which showed that the test was insignificant (p>.05). Hence, the pre-test results of both group were insignificant and were normally distributed.

Table 4.2

Descriptive Statistics for Pre-test Scores in Experimental Group and Control Group

	Group	N	Mean	Std. Deviation	Std. Error Mean
Pre-test	Experimental group	36	51.06	8.08	1.35
	Control group	34	48.76	8.56	1.47

According to Table 4.2, the mean score of the experimental group was 51.06 whereas the mean score of the control group was 48.76. This showed that the mean scores between experimental group and control group were close to each other where the mean difference was 2.30.

Table 4.3

Independent Samples T-test Findings for Pre-test Scores in Experimental Group and Control Group

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	.14	.71	1.15	68	.25	2.30	1.99	-1.68	6.26
Equal variances not assumed			1.15	67	.25	2.30	1.99	-1.68	6.27

The t-test result was not significant difference ($t(68)=1.15$, $p>.05$). There was no difference between the average pre-test scores of the pupils in the experimental group and the control group. This finding showed that the academic level of the groups were similar before the Jigsaw Cooperative Approach and conventional teaching were applied.

In Science Academic Achievement Test, the questions were set to investigate the pupils' mastery on applying and analysing skills. The Independent Samples T-test had been done to examine whether there is any significant difference between the scores for the questions to examine the pupils' applying skill and analysing skill in the experimental group and the control group.

Table 4.4

Descriptive Statistics for Pre-test Scores (Questions for Applying Skill) in Experimental Group and Control Group

		N	Mean	Std. Deviation	Std. Error Mean
Pre-test (Applying skill)	Experimental group	36	28.33	4.40	.73
	Control group	34	28.00	4.95	.85

The result above showed that the mean score for the questions to examine pupils' applying skill in the experimental group was 28.33 whereas the mean score of the control group was 28.00. This showed that the mean scores for the questions to examine the pupils' applying skill between the experimental group and the control group were close to each other where the mean difference was 0.33.

Table 4.5

Independent Samples T-test Findings for Pre-test Scores (Questions for Applying Skill) in Experimental Group and Control Group

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	.25	.62	.30	68	.77	.33	1.12	-1.90	2.56
Equal variances not assumed			.30	65.97	.77	.33	1.12	-1.90	2.57

The t-test result was not significant difference ($t(68)=.30$, $p>.05$). There was no difference between the average pre-test scores for the questions to examine the pupils' applying skill in the experimental group and the control group.

Table 4.6

Descriptive Statistics for Pre-test Scores (Questions for Analysing Skill) in Experimental Group and Control Group

		N	Mean	Std. Deviation	Std. Error Mean
Pre-test (Analysing skill)	Experimental Group	36	22.72	4.51	.75
	Control Group	34	20.76	4.51	.77

The result above showed that the mean score for the questions to examine the pupils' analysing skill of the experimental group was 22.72 whereas the mean score

of the control group was 20.76. This showed that the mean scores for the questions to examine the pupils' analysing skill between the experimental group and the control group were close to each other where the mean difference was 1.96.

Table 4.7

Independent Samples T-test Findings for Pre-test Scores (Questions for Analysing Skill) in Experimental Group and Control Group

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	.02	.89	1.81	68	.07	1.96	1.08	-.20	4.11
Equal variances not assumed			1.81	67.77	.07	1.96	1.08	-.20	4.11

The t-test result was not significant difference ($t(68)=1.81$, $p>.05$). Hence, the average pre-test scores for the questions to examine the pupils' analysing skill in the experimental group and the control group were no difference. It can be concluded that the pupils' ability in mastering applying skill and analysing skill were not significantly difference in both groups before the intervention.

4.2.2 Independent Samples T-test Results for the Post-test Scores between Experimental and Control Group

After the Jigsaw Cooperative Approach and conventional teaching were implemented, post-test was applied to the experimental group and the control group to compare the Science academic achievement of the pupils. The Normality Test was carried out on the data of the post-test.

Table 4.8

Normality Test for Post-test Scores in Experimental Group and Control Group

Group	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Experimental Group	.11	36	.20*	.97	36	.40
Control Group	.10	34	.20*	.97	34	.44

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

For the test of normality, the data of the post-test for the experimental group was normally distributed as the value of Kolmogorov-Smirnov and Shapiro-Wilk were .20 and .40 respectively, which showed the test was insignificant (p>.05). Besides, the data of the post-test for the control group was normally distributed as the value of Kolmogorov-Smirnov and Shapiro-Wilk were .20 and .44 respectively, which also showed that the results were insignificant (p>.05). The data for both groups were normally distributed.

Table 4.9

Descriptive Statistics for Post-test Scores in Experimental Group and Control Group

	Group	N	Mean	Std. Deviation	Std. Error Mean
Post-test	Experimental group	36	70.22	8.01	1.34
	control group	34	61.18	11.22	1.92

According to the finding in table above, the mean score of post-test for the experimental group was 70.22, which was higher than the mean score of the control group, 61.18. The mean difference value 9.04 showed that the pupils in the experimental group (mean score = 70.22) were more capable of mastering the questions in terms of the applying and analysing skills compared to the pupils in the control group (mean score = 61.18).

Table 4.10

Independent Samples T-test Findings for Post-test Scores in Experimental Group and Control Group

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	3.70	.06	3.90	68	.00	9.04	2.32	4.42	13.68
Equal variances not assumed			3.86	59.44	.00	9.04	2.34	4.36	13.73

The result of T-test indicated that there was a significant difference between the post-test scores of the experimental group and the control group in terms of applying and analysing skills after the Jigsaw Cooperative Approach was carried out ($t(68)=3.90$, $p<.05$).

Independent Samples T-test also had been done to examine whether there is any significant difference between the post-test scores for the questions to examine the pupils' applying skill and analysing skill in the experimental group and the control group.

Table 4.11

Descriptive Statistics for Pre-test Scores (Questions for Applying Skill) in Experimental Group and Control Group

		N	Mean	Std. Deviation	Std. Error Mean
Post-test (Applying skill)	Experimental Group	36	37.06	3.59	.60
	Control Group	34	33.94	4.74	.81

The result above showed that in the post-test, the mean score for the questions to examine the pupils' applying skill of the experimental group was 37.06 whereas the mean score of the control group was 33.94. The mean difference was 3.12.

Table 4.12

Independent Samples T-test Findings for Post-test Scores (Questions for Applying Skill) in Experimental Group and Control Group

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	2.78	.10	3.11	68	.00	3.12	1.00	1.12	5.11
Equal variances not assumed			3.09	61.5	.00	3.12	1.01	1.10	5.13

The t-test result showed that there was a significant difference ($t(68)=3.11$, $p<.05$) between the average post-test scores for the questions to examine the pupils' applying skill in the experimental group and the control group. This showed that the pupils developed their applying skill after the implementation of Jigsaw Cooperative Approach.

Table 4.13

Descriptive Statistics for Post-test Scores (Questions for Analysing Skill) in Experimental Group and Control Group

		N	Mean	Std. Deviation	Std. Error Mean
Post-test (Analysing skill)	Experimental Group	36	33.17	5.16	.86
	Control Group	34	27.24	7.17	1.23

The result above showed that in the post-test, the mean score for the questions to examine the pupils' analysing skill of the experimental group was 33.17 whereas the mean score of the control group was 27.24. The mean difference was 5.93.

Table 4.14

Independent Samples T-test Findings for Post-test Scores (Questions for Analysing Skill) in Experimental Group and Control Group

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	4.09	.05	3.99	68	.00	5.93	1.49	2.97	8.90
Equal variances not assumed			3.95	59.7	.00	5.93	1.50	2.93	8.93

The t-test result showed that there was a significant difference ($t(68)=3.99$, $p<.05$) between the average post-test scores for the questions to examine the pupils' analysing skill in the experimental group and the control group. This showed that the analysing skills among the pupils had been improved after carrying out Jigsaw Cooperative Approach.

It can be concluded that the pupils' ability in mastering applying skill and analysing skill in the experimental group was significant difference with the pupils' ability in mastering applying skill and analysing skill in the control group after Jigsaw Cooperative Approach was carried out in the experimental group. This indicated that Jigsaw Cooperative Approach was an effective method that can facilitate the mastery of applying skill and analysing skill compared to conventional teaching. This was also supported by the difference of the mean scores as the mean score of the post-test for the experimental group (70.22) was significantly higher than the mean score of the post-test for the control group (61.18). This can be concluded that the pupils in the experimental group performed better than the pupils in the control group in the post-test.

4.2.3 Paired-Samples T-test Results for the Pre-test and Post-test Scores within the Experimental Group

In this study, Paired-samples T-test had been carried out to determine if there is a difference between the mean scores of pre-test and post-test in the experimental group.

Table 4.15

Descriptive Statistics for Pre-test and Post-test Scores in Experimental Group

	Mean	N	Std. Deviation	Std. Error Mean
Pre-test of Experimental Group	51.06	36	8.08	1.35
Post-test of Experimental Group	70.22	36	8.01	1.34

Based on the data in Table 4.15, the mean score of the post-test (70.22) in the experimental group was significantly higher than the mean score of the pre-test in the experimental group (51.06). The difference between the mean scores of the pre-test and post-test in the experimental group was 19.16.

Table 4.16

Paired-Samples T-test Findings for Pre-test and Post-test Scores in Experimental Group

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Experimental Group	-19.16	7.64	1.27	-21.75	-16.58	-15.05	35	.00

The significance value for the Paired-samples T-test finding in the experimental group was smaller than .05, so the t-test result was significant ($t(35)=-15.05$, $p<.05$). Hence, the result showed that Jigsaw Cooperative Approach was able to increase the pupils' Science academic achievement.

Table 4.17

Descriptive Statistics for Pre-test and Post-test Scores (Questions for Applying Skill)in Experimental Group

		Mean	N	Std. Deviation	Std. Error Mean
Scores (Applying skills)	Pre-test	28.33	36	4.40	.73
	Post-test	37.06	36	3.59	.60

Table 4.18

Paired-Samples T-test Findings for Pre-test and Post-test Scores (Questions for Applying Skill) in Experimental Group

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Scores (Applying skills)	Pre-test-Post-test	-8.73	3.62	.60	-9.95	-7.50	-14.48	35	.00

Based on the Table 4.18, the Paired-samples T-test finding in the experimental group showed that there was a significant difference ($t(35) = -14.48$ $p<.05$) in the pupils' mastery of applying skills before and after the implementation of Jigsaw Cooperative Approach. The mean score value was increased from 28.33 to 37.06 after the Jigsaw Cooperative Approach was implemented. The mean difference was 8.73. The result showed that Jigsaw Cooperative Approach was able to increase the pupils' Science academic achievement by answering the applying skill questions.

Table 4.19

Descriptive Statistics for Pre-test and Post-test Scores (Questions for Analysing Skill) in Experimental Group

		Mean	N	Std. Deviation	Std. Error Mean
Scores (Analysing skills)	Pre-test	22.72	36	4.51	.75
	Post-test	33.17	36	5.16	.86

Table 4.20

Paired-Samples T-test Findings for Pre-test and Post-test Scores (Questions for Analysing Skill) in Experimental Group

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Scores (Analysing skills)	Pre-test-Post-test	-10.45	5.20	.87	-12.20	-8.69	-12.06	35	.00

The result above showed that there was a significant difference ($t(35) = -12.06, p<.05$) in the pupils' mastery of analysing skills before and after the implementation of Jigsaw Cooperative Approach. The mean score value was increased from 22.72 to 33.17 after the intervention. The result showed that Jigsaw Cooperative Approach was able to increase the pupils' academic achievement by answering the analysing skill questions.

From the Paired-samples T-test results, the difference of the mean score for the questions to examine the pupils' analysing skill (10.45) was higher than the difference of the mean score for the questions to examine the pupils' applying skill (8.73). However, the results indicated that the pupils' applying skill and analysing skill were enhanced after Jigsaw Cooperative Approach was implemented.

4.2.4 Paired-Samples T-test Results for the Pre-test and Post-test Scores within the Control Group

Paired-samples T-test also had been carried out to determine if there is a difference between the mean scores of pre-test and post-test in the control group.

Table 4.21

Descriptive Statistics for Pre-test and Post-test Scores in Control Group

	Mean	N	Std. Deviation	Std. Error Mean
Pre-test of Control Group	48.76	34	8.56	1.47
Post-test of Control Group	61.18	34	11.22	1.92

Based on the data in Table 4.21, the mean score of the post-test (61.18) in the control group was higher than the mean score of the pre-test in the control group (48.76). The difference between the mean scores of the pre-test and post-test in the control group was 12.42.

Table 4.22

Paired-Samples T-test Findings for Pre-test and Post-test Scores in Control Group

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Control Group	-12.42	5.39	.92	-14.29	-10.53	-13.43	33	.00

The significance value for the Paired-samples T-test finding in the control group was smaller than .05, so the t-test result was significant ($t(33) = -13.43$, $p<.05$). The result showed that conventional teaching was able to increase the pupils' Science academic achievement.

Table 4.23

Descriptive Statistics for Pre-test and Post-test Scores (Questions for Applying Skill) in Control Group

		Mean	N	Std. Deviation	Std. Error Mean
Scores (Applying skills)	Pre-test	28.00	34	4.95	.85
	Post-test	33.94	34	4.74	.81

Table 4.24

Paired-Samples T-test Findings for Pre-test and Post-test Scores (Questions for Applying Skill) in Control Group

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Scores (Applying skills)	Pre-test-Post-test	-5.94	2.68	.46	-6.87	-5.01	-12.96	33	.00

The Paired-Samples T-test finding in the control group showed that there was a significant difference(t(33) = -12.96, p<.05) in the pupils' mastery of applying skill before and after the implementation of conventional teaching. The mean score value was increased from 28.00 to 33.94 after the conventional teaching was implemented. The mean difference was 5.94. The result showed that conventional teaching was able to increase the pupils' Science academic achievement by answering the applying skill questions.

Table 4.25

Descriptive Statistics for Pre-test and Post-test Scores (Questions for Analysing Skill) in Control Group

		Mean	N	Std. Deviation	Std. Error Mean
Scores (Analysing skills)	Pre-test	20.76	34	4.51	.77
	Post-test	27.24	34	7.17	1.23

Table 4.26

Paired-Samples T-test Findings for Pre-test and Post-test Scores (Questions for Analysing skill) in Control Group

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Scores (Analysing skills)	Pre-test-Post-test	-6.48	4.78	.82	-8.14	-4.80	-7.90	33	.00

The result above showed that there was a significant difference (t(33) = -7.90, p<.05) in the pupils' mastery of analysing skill before and after the implementation of conventional teaching. The mean score value was increased from 20.76 to 27.24 after the conventional teaching was implemented. The mean difference was 6.48. The result showed that conventional teaching was able to increase the pupils' Science academic achievement by answering the analysing skill questions.

From the Paired-samples T-test result, the difference of the mean score for the questions to examine the pupils' analysing skill (6.48) was higher than the difference of the mean score for the questions to examine the pupils' applying skill (5.94). Meanwhile, the result indicated that the pupils' applying skill and analysing skill were be enhanced after the implementation of conventional teaching.

The Paired-samples T-test results in the experimental and the control group showed that both Jigsaw Cooperative Approach and Conventional Teaching brought significant effect on the pupils' Science academic achievement. This was because before the implementation of Jigsaw Cooperative Approach and Conventional Teaching, the pupils did not have prior knowledge on these two topics. So, after the intervention, they learned new information through the learning process and increased their understanding. Hence, they can answered the questions better in the post-test and then their post-test scores increased.

However, if compared to the mean difference between pre-test and post-test, the mean difference in the experimental group was significantly higher than the control group, there were 19.16 and 12.42 respectively. The results also showed that the difference of the mean scores for the questions to examine the pupils applying skill and analysing skill in the experimental group were higher than in the control group. These results indicated that the pupils in the experimental group mastered applying and analysing skills better than the pupils in the control group. This was also supported by the Independent T-test result where the post-test scores in the experimental group was significantly difference with the post-test scores in the control group. This indicated that Jigsaw Cooperative Approach was much more impactful compared to conventional teaching. The pupils in the experimental group

were more capable of answering the applying skill and analysing skill questions compared to the pupils in the control group.

Through Jigsaw Cooperative Approach, the pupils learned and applied these thinking skills during the group discussions and group activities. They analysed the questions asked by their group members, applied their knowledge to complete the task and answering the questions. Through these process, their applying and analysing skills were being enhanced.

4.3 Analysis of the Findings of the Cooperative Skills among Pupils

In this study, observation had been carried out twice, there were in the Cycle I and the Cycle II. In the Cycle I, the topic of "The Earth, the Moon and the Sun" had been taught and the topic of "Technology" had been taught in the Cycle II. In each cycle, the observation had been focused on the sharing information process and working for a group task process in home group. Two themes, "Positive Interdependence" and "Face-to-face Interaction" will be highlighted and discussed. The theme of Positive Interdependence referred to the effort of each group member. The efforts of each group member benefited to each person in the group. In the First cycle, there were three categories identified under this theme. There were Do Not Play Their Own Role, Involve Actively in Group Task and Accept Each Other's Opinion. In the Second cycle, where the pupils had undergone the Cycle I, the categories for Positive interdependence were Remind the Role of Each Other, Involve Actively in Sharing Information and Group Task and Respect Each Other.

The theme of Face-to-face interaction referred to the interaction that promote success of each other through sharing session. The pupils helped, supported, encouraged and praised each other. In the first cycle, there were three categories identified under this theme. There were Less Encouragement, Help Each Other in

Group Task and Share Ideas with Guidance. In the Second cycle, where pupils had undergone the Cycle I, the categories for Face-to-face interaction were Encouragement, Help Each Other in Sharing Information and Group Task and Exchange Ideas Together.

4.3.1 Positive Interdependence (Cycle I)

During information sharing of the topic of "The Earth, the Moon and the Sun" in the home group, the pupils took turn to teach and to learn subtopics from each other. The categories were Do Not Play Their Own Role, Involve Actively in Group Task and Accept Each Other's Opinion.

4.3.1.1 Do Not Play Their Own Role

During sharing information, some pupils did not play their role as a learner to listen to the sharing from their group members. This can be coded as Do Not Play Their Own Role. This was showed by Jayson who did not pay attention during the experiment. When Jun Yi explained how the shadow was formed, he was busy talking with his friends. So, he asked the group members where was the shadow formed in the experiment. Liew showed him the shadow formed on the paper.

Jun Yi explained when is at R position, the sun is on top of the stick. This is at noon. He pointed the shadow formed to group members. Jayson talked with Chong and they did not pay attention.

(Jayson, field notes)

Jun Yi : Now is at the R position. The sun is on top of the stick. This is at noon.
Jayson : Eh! Look! Where is the shadow?
Liew : Look carefully! Is here!
Chong : It's very short! How to draw?

(L037-040, SI, Cycle I)

During sharing information process, the pupils took turn to share their subtopics with the group members. Some group activities and experiment will be carried out in groups. Hence, assigned works was important to ensure the learning

was carried out smoothly. However, the pupils did not assign works when they shared their knowledge through the experiment. So, some pupils did not play their role and order their group members to do the task. This was also coded as Do Not Play Their Own Role. For example, Liew ordered her group members to record the results of the experiment but she did not do by her own.

Liew :Hey! Both of you! faster draw out the shadow formed.
Chong :How to draw?
Liew :Aiyo! use ruler! faster!

(L026-029, SI, Cycle I)

4.3.1.2 Involve Actively in Group Task

During information sharing, the pupils did not involve themselves actively. However, during working for a group task, the pupils showed their improvement. They involved themselves actively in the group task given. During working for a group task, the pupils needed to prepare a product that was related to the moon phase. During the conversation, the pupils took initiative to share their ideas in the preparation of the product. This was coded as Involve Actively in Group Task. When the teacher asked the way to make the product more interesting, Tan took initiative to share her ideas. Jayson also took initiative to share his idea on making a "Moon Phase Chess".

Teacher :How to make it more interesting?
Tan :Ah! I have an idea! We can use the oreo biscuits. The shape of the oreo biscuits are circles.

(L012-013, GT, Cycle I)

Jayson :I also have an idea. We can make a "Moon Phase" chess. It looks like the snake and ladder game. They will be moved represented by chess according to the number shown on the dice. If you are at the moon phase position, you need to name the moon phase. Then, if the answer is correct, you may get an opportunity to get a bonus.

(L027-030, GT, Cycle I)

Furthermore, Liew showed her interest in this group task. When she felt interested, she involved herself actively in the group task. This was also coded as Involve Actively in Group Task. When Jun Yi and Tan said they could take charge of the oreo biscuit activity, Liew wanted to work with them because she felt interest with this activity.

Liew :Good. How about the oreo biscuit activity? Who will be in charged?
Jun Yi and Tan : Both of us are in charged of this activity.
Liew :I am interested. I can help you all.

(L036-038, GT, Cycle I)

4.3.1.3 Accept Each Other's Opinion

Meanwhile, the pupils accepted each other's opinion in the process of working for a group task. This was coded as Accept Each Other's Opinion. When Ling explained her suggestion on preparing the product, Liew accepted her suggestion and added on her own ideas on the suggestion given by Ling.

Ling :So, maybe we can provide 8 different shapes of oreo biscuits. Then, they draw out a piece of paper and read the name of moon phase on the paper. Then, they need to choose the correct oreo biscuit which represent this moon phase.
Liew :Ok, can. Maybe after that they may arrange the oreo biscuits according to the sequence of the moon phase on a plate.

(L016-020,GT,Cycle I)

This also showed by Ling who agreed the suggestions of "Bonus" for the Chess Activity from Jayson by stating "Ok. Can be accepted." She agreed and accepted the suggestion of her group members during working for a group task.

Ling :Ok. 1 more?
Jayson :"move a person back to the starting point."
Ling :Ok. Can be accepted.

(L068-070,GT, Cycle I)

4.3.2 Positive Interdependence (Cycle II)

In the home group, the pupils shared the information for the topic of "Technology" that they learned and made a house model with their home group members in the Cycle II. In the Second cycle, the categories for positive interdependence were Remind the Role of Each Other, Involve Actively in Sharing Information and Group Task and Respect Each Other.

4.3.2.1 Remind the Role of Each Other

During the sharing information in the Cycle II, the pupils always remind the role of each other to make sure the experiment can be carried out smoothly. This was coded as Remind the Role of Each Other. Chong reminded Jun Yi to put the coins carefully during the experiment. Jun Yi explained that he just putting the coins back on the paper, not playing with the coins.

During the experiment, pupils put the coins one by one on the model. Chong reminded Jun Yi not play with the coins. Actually, Jun Yi was trying to put back the coins that fell from the model. Jun Yi explained to her politely.

(Chong, field notes)

Chong :Oh, put it carefully! Don't play with it.
Jun Yi :No, I just putting it back.

(L034-035, SI, Cycle II)

Besides, Jayson also reminded Ling to stop her action during the experiment. This was also coded as Remind the Role of Each Other. Jayson stopped Ling to put the coin after the paper of the model fell down. This was to ensure that the result of the experiment was accurate.

Jayson :Hey! Stop! don't put the coins again.
Ling :ok, stop. Now, how many coins still remain?

(L038-039, SI, Cycle II)

4.3.2.2 Involve Actively in Sharing Information and Group Task

The pupils enjoyed in the process of information sharing and working for a group task. The pupils carried out the experiment by putting coins on the models and observed which model will collapse first. The pupils were interested and actively involved themselves in the experiment. This was coded as Involve Actively in Sharing Information and Group Task. For example, the teacher asked the pupils to make assumption before carrying out the experiment. Some of them said it was the first model and some of them were not sure. Ling said she was not sure but she was interested with the result of the experiment. This showed that the pupils concerned and involved in group activities.

Teacher: Wait. Let us make the assumption. Do you think which model will fall down first?
Chong :I guess is the first model.
Jayson :Me too.
Jun Yi :I think is the first model.
Liew :I am not sure.
Ling :I also not sure but I am interest to know the results.

(L022-027,SI, Cycle II)

Furthermore, the pupils involved themselves actively in the process of working for a group task. They felt interest with the group task. This was also coded as Involve Actively in Sharing Information and Group Task. For example, Ling was very excited during the discussion about building the house model. She was interested with the model that will be made and involved herself in the group task.

Jun Yi suggested the ideas on how to construct the wall of the house model. Tan and Jayson agreed with the suggestion. Ling felt excited and smile by saying "Wow! Sound interesting!".

(Ling, field notes)

Jun Yi :Oh, Yes. We can arrange the ice-cream sticks in different arrangement. It will strengthen the house model. I think ten layers of ice-cream sticks will be enough. It cannot be too high, not stable.
Tan :I agree with you.

Jayson :Good idea. It looks like the arrangement of bricks similar to house wall.
Ling :Wow! Sounds interesting! How about the roof?

(L018-022, GT, Cycle II)

4.3.2.3 Respect Each Other

During information sharing, the pupils agreed with the group members' opinion. This can be coded as Respect Each Other. This was showed by Jun Yi who respected and agreed with the opinion of Jayson by saying "Yes, I think so too".

Teacher :Why you think is the first model?
Chong :I don't know.
Jayson :Because the flat paper is not strong.
Jun Yi :Yes, I think so too.

(L028-031, SI, Cycle II)

During the process of working for a group task, the task given was building a house model. The pupils listened the opinions of their group members. This was coded as Respect Each Other. The pupils also respected each other by asking opinions from their group members. For example, after Chong drew the house model, she asked the opinions from others.

Chong :Ok, let me draw the house model.Please can you all help to prepare the materials that we need.(draw the model and prepare materials)
Chong :Ok, done. Have a look. Is it ok?Anyone want to add on?

(L030-032, GT, Cycle II)

Some pupils also asked the permission and opinion of their group members. When they asked the questions, they looked at the pupils and asked questions friendly. This was also coded as Respect Each Other. Jun Yi reminded Chong the results of discussion where the roof was made by cardboard and folded into corrugated shape. He also listened to the opinion of Chong patiently. Chong voiced out her opinion on the decision made and discussed with Jun Yi.

Jun Yi asked the opinion of Chong on making the roof of the house model. Jun Yi looked at Chong and asked her politely.

(Jun Yi, field notes)

Chong :Jun Yi, we use this cardboard to make the roof, is it ok?
Jun Yi :Just now we discussed to use cardboard and fold it into corrugated shape. What is your opinion?
Chong :In my opinion, it is difficult to fold the cardboard into the corrugated shape. So, how?

(L048-050, GT, Cycle II)

After the observation, the researcher evaluated the pupils' overall performance during information sharing in the Cycle I by using rubric. The pupils' positive interdependence performance was in weak level. The pupils did not perform well in positive interdependence among each other. They did not played their own role well during sharing information. The did not pay attention and not divide the works evenly among group members. They also seldom involve themselves actively and seldom accept each other's' opinion in sharing information. They needed time to adapt and practice the cooperation in Jigsaw Cooperative Approach where it was different with their learning style.

Then, researcher evaluated the pupils' overall performance during working for a group task in the Cycle I by using rubric. The pupils' positive interdependence performance was in good level. Compared to the sharing information process, the pupils seem to progress in positive interdependence in the process of working for a group task. The pupils tended to involve themselves more actively in the group work such as took initiative to provide suggestion so that they can achieve the group's goal. They also felt interest with the group activities and took part on it. They started to accept each other's opinion as compared to the information sharing process. The pupils showed their positive progression in positive interdependence from sharing information process to working for a group task.

Besides, the researcher evaluated the pupils' overall performance during sharing information in the the Cycle II by using rubric. The pupils' positive interdependence performance was in good level. The pupils realised the importance of cooperation between the group members. They reminded each other to make sure the group activities can be carried out smoothly. They also tolerated with each other by accepting the advise from their group members. The pupils felt interest and enjoyed with the information sharing process. This conditioned them involved actively in the group activities.

In addition, according to the evaluation by using rubric, the pupils showed their excellent performance in the positive interdependence in working for a group task in the Cycle II. The pupils showed their improvement as compared to the process of information sharing. Each group member depended on each other and complemented each other without prompting. Each group member involved actively in the group work and carried out presentation together. They felt interested with the group works. They also respected each other and willing to learn and teach each other. The pupils listened to each other's opinion patiently. Each of them also accepted and asked the suggestion politely.

Compared to the information sharing process in the Cycle I, the pupils showed their improvement in positive interdependence in the Cycle II. They changed their attitude from did not play their own role to remind the role of each other in the Cycle II. They also felt interest and took part in sharing information and working for a group task in the Cycle II. They also learned to accept the suggestion from the group members. This was a good sign where the pupils enjoyed with Jigsaw Cooperative Approach.

Compared to the Cycle I, each pupil showed their improvement in the process of working for a group task in the theme of positive interdependence in the Cycle II. Each pupil carried out group work without prompting. The involved themselves actively in working for a group task. They learned to listen their group members opinions patiently and respected each other by asking for opinions. They discussed the information properly and able to cooperate in the process of building the house model.

4.3.3 Face-to-face Interaction (Cycle I)

In group discussion, the pupils implemented face-to-face interaction. The categories for face-to-face interaction in the Cycle I were Less Encouragement, Help Each Other in Group Task and Share Ideas with Guidance.

4.3.3.1 Less Encouragement

The pupils seldom gave encouragement to their group members during sharing information in the Cycle I. This was showed when Ling asked the permission to hold the torch light during experiment, Jayson answered her and forced her to start the experiment faster. This can be coded as Less Encouragement. Jayson should encourage Ling, for example "You can. I believe you can do it."

Ling :I will hold the torch light, is it ok?
Jayson :Sure. Start faster !

(L024-025, SI, Cycle I)

Furthermore, when Chong was not confident to draw the short shadow of stick at noon, Ling answered loudly and took away her pencil to demonstrate the correct way to draw the exact size of the shadow to Chong. This was also coded as Less Encouragement. Ling should motivate her by saying "Draw according to what you see. Believe yourself!"

During experiment, they need to draw the shadow formed. Chong found that the shadow was too short and did not know how to draw. When she asked her group members, Ling answered her loudly and took away her pencil to demonstrate the correct way to draw the exact size of the shadow.

(Ling, field notes)

Chong :It's very short! How to draw?
Ling :Draw the exact size!

(L040-041, SI, Cycle I)

4.3.3.2 Help Each Other in Group Task

In the First cycle, the pupils seldom helped on each other during information sharing. However, they always help each other to finish the group task. This was coded as Help Each Other in Group Task. This was shown by Liew who helped their group members to draw the chess map after she finished her own task in the process of preparing the group activities.

Liew :I finished my work. Let me draft a chess map. It has 100 grids.
Ling :Ok, remember to draw the moon phase at different position.

(L056-057, GT, Cycle I)

In addition, Ling had helped her group members to make a conclusion on the two activities that will be prepared later based on the discussion. She had helped her group members to summarise the important suggestions and decision made in the discussion.

Ling :Ok, let me make a conclusion. During presentation, we prepare 2 activities. The first activity is recognise the moon phase and arrange it according to the sequence on a plate. The second activity is the" Moon Phase" chess. People move their chess according to the number on the dice. If they move to the moon phase position, they need to name the moon phase. If their answer is correct, they may get an opportunity to get a bonus.

(L043-047, GT, Cycle I)

4.3.3.3 Share Ideas with Guidance

During sharing information, the teacher guided the pupils to share ideas about the experiment that they did in their group. The teacher had guided them

to make conclusion on the experiment. This can be coded as Share Ideas with Guidance. The teacher moved around and noticed that they did the experiment. The teacher smiled and asked them to explain the results of experiment and then guided them to draw the conclusion.

The teacher walked around and stand beside the group. The pupils did the experiment and sat quietly in their group. The teacher looked at them and smiled. She asked them to tell her the results of the experiment. The teacher had also guided them to make conclusion for this experiment.

(Teacher, field notes)

Teacher :Can you state the answer for all of us?
Liew :Ok. At T and S positions, the direction of the shadow is in the West. At R position, the direction of the shadow is in the middle. At Q and P positions, the direction of the shadow is in the East.
Teacher :From this result, what can you all conclude?
Liew :When the sun is in the East, the shadow will be in the West.
Chong :When the sun is in the West, the shadow will be in the East.
Tan :At noon, the sun is on top. The shadow is in the middle.
Ling :The position of the shadow always opposite with the position of the sun.

(L052-060, SI, Cycle I)

This trait was also showed by Tan who acted as the leader and guided the group members to understand the Science concept by carrying out demonstration. She guided the pupils to answer the questions by saying "Try to think!" and "Don't worry, just try". She had also asked some Socratic questions to assist the pupils to understand the concept of the moon reflects the sunlight. After that, Chong was able to explain the Science concept. This proved that the pupils were able to relate the demonstration with the prior knowledge.

Tan :Is there anyone who can explain about it?
Jayson :I don't know. (Others keep quiet)
Tan :Try to think! The mirror represents the moon. If you see the light in the mirror, what does it mean ?
Tan :Don't worry, just try.
Jun Yi :Erm.....
Tan :Is the moon able to shine by itself?
Jayson, Liew, Ling :No.
Tan :True. So, how can you see the light in the mirror?

Chong :The mirror reflects the light, so that we can see the light in the mirror.

(L077-085, SI, Cycle I)

Tan asked the Socratic questions such as "Try to think! The mirror represents the moon. If you see the light in the mirror, what does it mean?". This was the questions about viewpoints and perspectives. She wanted to collect the viewpoints from group members. She also asked the questions for clarification "True. So, how can you see the light in the mirror?". With the guiding of Socratic questions, Chong was able to understand and explained that they can see the light in the mirror because the mirror reflected the light.

4.3.4 Face-to-face Interaction (Cycle II)

The pupils learned the topic of "Technology" in the Cycle II. Observation also had been carried out during the pupils sharing information and working for a group task. The categories for this theme in the Cycle II were Encouragement, Help Each Other in Sharing Information and Group Task and Exchange Ideas Together.

4.3.4.1 Encouragement

During information sharing, the pupils motivated their group members to share opinions. This can be coded as Encouragement. For example, Tan explained her opinion by giving the reason. Pupil B agreed and said "Ok, good."

Liew :Ok, let me help you. Put here. Do we need to make sure that the distance between two blocks of two models are the same?
Ling :Why?
Tan :I think yes. So that it won't affect the results of experiment.
Ling :Ok, good.

(L015-019, SI, Cycle II)

Besides, when Liew tried to explain the reason for the experiment result, some pupils agreed with her reason. Jayson encouraged her by saying "Yes, you are right." This also can be coded as Encouragement.

Liew :Was the coin pressure distributed unevenly in the first model?
Tan :Oh yes. The pressure was distributed evenly at the second model.
Chong :I agree with you.
Ling :I understood. This is the inference!
Jayson :Yes, you are right. So, we should record the observation in the table now.
(L060-064, SI, Cycle II)

During working for a group task, the pupils always encourage their group members. These showed that they motivated each other in completing the house model. For example, Jayson supported and praised the ideas of Jun Yi to arrange the ice-cream sticks in different arrangement by saying "Good idea."

Jun Yi :Oh, Yes. We can arrange the ice-cream sticks in different arrangement. It will strengthen the house model. I think ten layers of ice-cream sticks is enough. It cannot be too high, not stable.
Tan :I agree with you.
Jayson :Good idea. It looks like the arrangement of bricks similar to house wall.
(L018-021, GT, Cycle II)

4.3.4.2 Help Each Other in Sharing Information and Group Task

In the Cycle II, the pupils helped on each other during information sharing and working for a group task. This can be coded as Help Each Other in Information Sharing and Group Task. During information sharing on the subtopic of "Strength of the building", the pupils made two models for the experiment. They helped on each other such as Liew helped her group members to build the model during the experiment.

Jun Yi asked his group members to start the experiment by setting up the model. Liew offered help to Tan, asked Tan put the blocks on the table and set up the model.
(Liew, field notes)

Jun Yi :Can we start to set up the models now?
Tan :Of course. Three of you set up the first model and three of us will set up the second one.
Liew :Ok, let me help you. Put here. Do we need to make sure the distance between the two blocks of the two models are the same?
(L012-016, SI, Cycle I)

Furthermore, Ling had helped Jun Yi to record the result of the experiment when Jun Yi counted the coins and reported the result of the experiment to group members.

Ling :Ok, stop. Now, how many coins still remain?
Jun Yi :We still have 37. That's mean the model only can support 82 coins.
Ling :Ok, let me help you record it in the table.

(L039-042, SI, Cycle II)

The pupils also worked together to finish the group task. The pupils had helped on each other to construct the house model. They arranged the ice-cream sticks and glued the ice-cream sticks together to make the wall of the house model.

Liew passed the glue to Jun Yi and Jun Yi helped Liew to hold the ice-cream stick when she glued the ice-cream stick.

(Jun Yi, field notes)

Ling :Not sure. We arrange it one by one first.
Jun Yi :Can you pass me the glue?
Liew :Yes. Help me to hold it. Let it dry.
Jayson :How to combine the ice-cream sticks with the base?
Ling :You may try to use UHU glue or double sided tape.
Tan :I think we should borrow hot gun from the teacher. It will stick the materials together stronger.
Liew :Ok, I will borrow with teacher.

(L040-047, GT, Cycle II)

After Jayson had done with the base of the house model, he was also wiling to help his group members to build the wall of the house model so that they can finish faster.

Liew :Jayson, can you help us to build the wall so that we can finish it faster?
Jayson :Sure.

(L058-059, GT, Cycle II)

4.3.4.3 Exchange Ideas Together

Each group member involved in sharing information and working for a group task. They shared and exchanged ideas together by accepting and refusing ideas politely without guidance. This was coded as Exchange Ideas Together. For

example, the pupils exchanged their ideas on how to manage the materials that can be recycled. When Liew asked the Socratic questions about viewpoints and perspectives such as "Do you know what can be done to the objects that can be recycled?", the pupils shared ways to managed the objects before sending the objects to recycle center. Through Socratic questions, the pupils shared their own experience with each other. This enable the pupils to learn the knowledge from different point of view.

Liew :Do you know what can be done to the recyclable objects?
Ling :Send it to the recycle center.
Jayson :Wait, we can reuse some of it such as cardboard, papers..... before recycling.
Tan :Yes. Before sending it to the recycle center, make sure the objects are clean. If not, it cannot be recycled.
Jun Yi :We should classify the objects before sending it to the recycle center. This make it easier for the worker

(L106-111, SI, Cycle II)

The pupils also related daily life objects with the recycle activity. They exchanged their ideas and opinion together, they discussed whether the certain objects can be recycled. They answered the questions and provided the reasons. They implemented and related the knowledge into daily life. This showed that they practised applying skill and analysing skill in group discussion. For example, Tan asked Socratic questions about the viewpoints and perspectives, "Do you think photograph can be recycled?". This questions induced deep thinking among group members.

Jayson :Plastic bottles can be recycled. How about plastic wrap?
Ling :I think can't. How about light bulb?
Tan :Glass bottle can be recycled but light bulb cannot because there is tungsten inside the bulb.
Ling :Ok.
Chong :Is it true that contaminated or dirty things like contaminated paper towels and plastic bags cannot be recycled?
Liew :Yes, you are right.
Tan :Do you think photograph can be recycled?

Jun Yi :I think no. It cannot be recycled and cannot be used to produce a new one.
(L091-100, SI, Cycle II)

In the process of working for a group task, the pupils discussed and exchanged their ideas. For example, Jun Yi did not know how shapes were related to the strength of the house model. He promoted a Socratic question to probe reason and evidence. Tan explained the reason to him. From the conversation, the pupils analysed the questions asked by group members and applied their Science knowledge in new situation.

Liew :In my opinion, the tiles are in corrugated shape.
Jayson :So, any suggestion? Jun Yi, you have anything to say?
Jun Yi :How does this shape related to the strength of the house model? I am not clear about it.
Tan :The corrugated shape may distribute the pressure evenly into all direction. so, the house model will be strengthen.
(L023-027, GT, Cycle II)

Besides, the pupils also shared their ideas on how to build a house model with recycled materials. Liew asked the Socratic questions about viewpoints and perspectives such as "How to enhance the strength of the house model?". Chong also asked the Socratic questions for clarification such as "What are the factors?". Jun Yi added his idea on top of the suggestion by Ling. This was a good phenomenon where pupils had demonstrated their own thinking in the process of discussion. They applied what they learned in this topic such as stability and strength of the building to provide suggestions. Then, Jun Yi also analysed the suggestion to suit with their group goal by stating that the house model cannot be too high because it is not be stable.

Liew :How to enhance the strength of the house model?
Jayson :I think we should consider the factors that influence the strength and the stability of the building.
Chong :What are the factors?
LIng :The factors are the materials of the structure,shape of the building, height and the base surface area.

Jun Yi *:Oh, Yes. We can arrange the ice-cream sticks in different arrangement. It will strengthen the house model. I think ten layers of ice-cream sticks should enough. It cannot be too high, not stable.*

(L014-019, GT, Cycle II)

With the evaluation of the pupils' face-to-face interaction by using rubric in the Cycle I, the group performance in information sharing was in moderate level. At first, they seldom encourage, motivate and praise each other. They also seldom help each other in sharing information but this was changed in working for a group task. They also shared ideas with guidance. The teacher and peers assisted them to share ideas. They worked as the role of More Knowledgeable Others (MKO).

The pupils' performance for the face-to-face interaction in working for a group task was in good level in the Cycle I. They showed their improvement from sharing information to the process of working for a group task. The pupils showed their improvement in encouraging group members and helped each other in group task such as helping group members to prepare the products for group presentation. They also shared ideas without guidance.

In the Cycle II, after evaluating the pupils' performance on face-to-face interaction by using rubric, their overall face-to-face interaction was in excellent level during sharing information and working for a group task. During information sharing, the pupils helped each other, gave encouragement and exchanged ideas. They also practised Socratic questions in their group discussion.

During working for the group task, the pupils were able to help each other to identify necessary changes and encourage group action for change. They started to share more related information on Science topic with group members. They also exchanged constructive opinions and resources to their group members when they build the house model. With the support of Socratic questions, they explored the

Science topics from different point of view by implementing applying skill and analysing skill.

The pupils showed improvement in face-to-face interaction from the Cycle I to the Cycle II. The pupils realised the importance of providing suitable encouragement to motivate each other during information sharing . They also helped on each other to solve the problems and shared the knowledge together. They were not only shared ideas in group but exchanged ideas together. In the discussion, the pupils promoted Socratic questions such as Questions for clarification, Questions that probe reasons and evidence, Questions about viewpoints and perspectives and etc. From the discussion, the pupils received thoughtful responses and able to implement applying skill and analysing skill in the process of solving problems and making decisions.

4.4 Analysis of the Findings of Pupils' Perceptions on Jigsaw Cooperative Approach as a Science Learning Method

From the results of Science Academic Achievement Test and observation during teaching and learning process, teacher identified the pupils' development in mastering applying and analysing skills. To examine Year Five pupils' perceptions on Jigsaw Cooperative Approach as a Science learning method, the researcher distributed the questionnaire to the pupils in the experimental group. Five Likert scales had been used in the questionnaire.

For the purpose of analysis, those who agreed and strongly agreed were combined into one group as they agreed with the statements. Respondents who disagreed and strongly disagreed were combined into one group as they disagreed with the statements (Gosavi, 2015). To analyse the findings, the data for "Strongly Disagree" was merged with the data for "Disagree" whereas the data for "Strongly Agree" was merged with the data for "Agree". Below was the descriptive analysis of

the questionnaire data that was related to the pupils' perceptions on Jigsaw Cooperative Approach as a Science learning method.

Table 4.27

Frequency and Percentage of Pupils' Perceptions on Jigsaw Cooperative Approach as a Science Learning Method

	Statements	Disagree	Neutral	Agree
1	This approach helps me to learn new thing easily.	2 (5.56%)	11 (30.56%)	23 (63.89%)
2	This approach helps me to acquire knowledge through working in a team.	4 (11.11%)	6 (16.67%)	26 (72.22%)
3	This approach makes me understand my work because my friends explain them well.	1 (2.78%)	7 (19.44%)	28 (77.78%)
4	This approach helps everyone achieve the objectives.	7 (19.44%)	11 (30.56%)	18 (50.00%)
5	I feel happy to learn Science through this approach.	3 (8.33%)	3 (8.33%)	30 (83.33%)
6	Through this approach, I like to share my knowledge with my friends.	3 (8.33%)	8 (22.22%)	25 (69.44%)
7	This approach trains me listen better to what my friends say.	4 (11.11%)	6 (16.67%)	26 (72.22%)
8	This approach creates a good relationship among group members.	7 (19.44%)	7 (19.44%)	22 (61.11%)
9	The lessons become more interesting with this approach.	3 (8.33%)	4 (11.11%)	29 (80.56%)
10	I feel actively involved in all activities through this approach.	4 (11.11%)	13 (36.11%)	19 (52.78%)
11	This approach helps me to organise the content of the topic.	2 (5.56%)	9 (25.00%)	25 (69.44%)
12	This approach helps me to solve problems by applying knowledge in the situation.	4 (11.11%)	8 (22.22%)	24 (66.67%)
13	This approach helps me to relate the knowledge that I learned with my daily life.	1 (2.78%)	5 (13.89%)	30 (83.33%)
14	This approach enable me to implement the knowledge that I learned to finish the task given.	2 (5.56%)	6 (16.67%)	28 (77.78%)
15	This approach enable me to ask questions in different ways when I am not understand the meaning.	3 (8.33%)	8 (22.22%)	25 (69.44%)

From table 4.27, the frequency and the percentage of the pupils marking on each statement was shown. Out of 15 statements in questionnaire, there were two statements that most pupils agreed with which were Statement 5 and Statement 13. Among 36 pupils, 30 pupils (83.33%) agreed that "I feel happy to learn Science through this approach." and "This approach helps me to relate the knowledge that I learned with my daily life.". This showed that the pupils like to learn Science by using Jigsaw Cooperative Approach which allowed them to sit with group members and learn in groups. This was the new experience for them. Based on the observation, the pupils started to take initiative to involve in the group activities during working for a group task in the Cycle I and sharing information and working for a group task in the Cycle II. The pupils were also interested with the learning process when Jigsaw Cooperative Approach was carried out. Then, the pupils stated that they were interested with the group work such as the house model being the group goal.

Besides, most of them agreed that Jigsaw Cooperative Approach had helped them to relate the knowledge that they had learned with their daily life. Through the learn and teach sessions and group activities, the pupils stated that they are able to relate what they had learned in daily life to the group task, such as building the house model using recycled materials. Through observation, the pupils discussed about the issue of recycling and the Science topic that they learned in groups. They answered the questions and provided reasons based on their Science knowledge. The pupils implemented the applying skill and analysing skill in the process of relating the knowledge that they had learned in their daily life. This proved that they had mastered the applying skill and analysing skill much better comparing to before.

A few of the pupils disagreed with the Statements 4 and Statement 8, " This approach helps everyone achieve the objectives." and "This approach creates a good

relationship among group members.". The percentage of the pupils who disagreed with these statements were 19.44%. 7 out of 36 pupils disagreed with this approach helped everyone achieved the objectives because they found that not everyone achieved the objectives by using Jigsaw Cooperative Approach. Based on the observation, some of the pupils did not collaborate with their group members and did not pay attention at the beginning of the learning. For example, Jayson talked with Chong when Jun Yi started to explain his subtopic. In addition, pupils also did not have confident to voice out their own answers. They preferred to sit quietly and listen the answers or instruction from the leader. Hence, some pupils found that the objectives of the learning were not achieved by everyone.

A few of the pupils also disagreed with Jigsaw Cooperative Approach created a good relationship among group members. Though observation, this was because some of the pupils were considered rude at the beginning when they communicated with their group members. They shouted loudly during the experiment and ordered their group members to work. They also rushed their group members to carry out the activities. The leaders in the groups was not able manage the conflict well in the group. So, some of the pupils disagreed that this approach could create a good relationship among group members.

In the questionnaire, the pupils' perceptions on Jigsaw Cooperative Approach as a Science learning method was being studied in three aspects, there were academic learning, cooperation and mastering of applying skill and analysing skill. The descriptive statistics had been used to analyse the data.

Table 4.28

Descriptive Statistics of the Pupils' Perceptions on Academic Learning after the Implementation of Jigsaw Cooperative Approach

	Statement 1	Statement 2	Statement 3	Statement 4	Statement 5
Mean	3.81	3.92	4.06	3.42	4.17
Median	4.00	4.00	4.00	3.50	4.00
Mode	4.00	4.00	4.00	4.00	4.00[a]

a. Multiple modes exist. The smallest value is shown

According to the data in the Table 4.28, it can be found that the pupils agreed with Jigsaw Cooperative Approach assisted the pupils to increase their academic learning in Science. The median values showed that the pupils agreed with the Statement 1,2,3 and 5 but moderately agreed with the Statement 4, where the median value was 3.5, in between neutral and agree levels. The pupils moderately agreed with the statement " This approach helps everyone achieve the objectives." The mode is the value that occurs most frequently in a distribution. The mode values for the statements above was 4.0. This showed that most pupils agreed with the Statement 1 to 5 which concluded that Jigsaw Cooperative Approach can enhance pupils' academic learning in Science.

The results of observation supported this conclusion. Based on observation, the pupils showed their improvement in the process of sharing information and their own ideas. In the cycle II, the pupils not only shared resources but also exchanged their own opinions during the discussion. They shared their opinion and provided Science knowledge to support it. This showed that the pupils developed their academic learning and able to apply the Science knowledge and related with their daily life through the implementation of Jigsaw Cooperative Approach.

Table 4.29

Descriptive Statistics of the Pupils' Perceptions on Cooperation after the Implementation of Jigsaw Cooperative Approach

	Statement 6	Statement 7	Statement 8	Statement 9	Statement 10
Mean	3.78	4.06	3.69	4.08	3.56
Median	4.00	4.00	4.00	4.00	4.00
Mode	4.00	5.00	5.00	4.00	3.00[a]

a. Multiple modes exist. The smallest value is shown

The data in the Table 4.29 showed that the pupils agreed with Jigsaw Cooperative Approach motivated them and they were more cooperative in the learning. The median values showed that pupils agreed with the Statement 6 to 10. There were multiple mode values for the statement 10. The smallest mode value for the Statement 10 was 3.0, which showed that some pupils felt neutral with the statement "I feel actively involved in all activities through this approach." The mode values for other statements were above 4.0. This indicated that the pupils were agreed with that they had learned to cooperate through Jigsaw Cooperative Approach.

This was also proven by the data of the observation. During the implementation of Jigsaw Cooperative Approach, the pupils learned to assign works and sometimes the pupils volunteered to do the works. They also showed their improvement in listening to each other opinions and encourage each other. Furthermore, they helped each other in the process of working for a group task such as preparing the products related to the Science topic and building the house model. They also enjoyed sharing with their group members and it enhanced their relationship. Hence,the pupils experienced the benefits of cooperation through Jigsaw Cooperative Learning.

Table 4.30

Descriptive Statistics of the Pupils' Perceptions on Mastering of Applying Skill and Analysing Skill after the Implementation of Jigsaw Cooperative Approach

	Statement 11	Statement 12	Statement 13	Statement 14	Statement 15
Mean	3.92	3.83	4.19	4.08	3.94
Median	4.00	4.00	4.00	4.00	4.00
Mode	4.00	4.00	4.00	4.00[a]	4.00

a. Multiple modes exist. The smallest value is shown

The data in the Table 4.30 revealed that the pupils agreed that Jigsaw Cooperative Approach has effects on mastering of applying skill and analysing skill. The median values and mode values were 4.0, which showed that the pupils agreed with Statement 11 to 15. The pupils agreed that this approach helped them to organise the content of the topic, able to relate the knowledge in daily life, able to implement the knowledge, solved the problems by using applying skill and analysing skill and able to ask questions in different perspectives.

This conclusion was supported by observation data. According to the observation data, the pupils summarised the important notes of each subtopic in a mind map. The pupils also discussed in groups by promoting Socratic questions. Through Socratic questions, the pupils received suggestions from different angle and thoughtful responses. In making decision, they chose and selected the suitable suggestion by implementing applying and analysing skill. For example, Chong found that it was difficult to for cardboard to be folded it into corrugated shape. Through discussion, they decided to make it in an arch shape which was like the shape of a bridge. These showed that the pupils had mastered applying skill and analysing skill through Jigsaw Cooperative Approach, which was similar with the pupils' perceptions on mastering of applying skill and analysing skill after the intervention.

In addition, the Paired-samples T-test results supported this conclusion. Based on the Paired-samples T-test results, the difference of the mean scores of the questions to examine the pupils' applying skill in the pre-test and post-test was 8.73 whereas the difference of the mean scores of the questions to examine the pupils' analysing skill in pre-test and post-test was 10.45. These showed that the pupils had mastered applying skill and analysing skill much better after Jigsaw Cooperative Approach was carried out.

4.5 Summary

In this chapter, analysis of data collected and interpretation had been done. The results of the Independent T-test showed that there was a significant difference between the post-test scores of the experimental group and the control group. The pupils in the experimental group were more capable of mastering the applying skill and analysing skill questions. Through the observation, the pupils became more cooperative with their group members in the process of learning after Jigsaw Cooperative Approach was carried out. From the data of questionnaire, the pupils had positive perceptions on Jigsaw Cooperative Approach as a Science learning method. In the following chapter, discussion of the results, suggestions, implications and conclusion will be discussed.

CHAPTER 5

DISCUSSION AND CONCLUSION

5.1 Introduction

The discussion of the results, implication of the study, suggestions for further research and conclusion of the study will be discussed in this chapter.

5.2 Discussion of the Findings

Discussion were carried out based on the findings of Science Academic Achievement Test, observation and questionnaire with the research questions in this study.

5.2.1 Research Question 1: Is there any significant difference between the post-test scores of experimental group and control group in terms of applying and analysing skills after the Jigsaw Cooperative Approach and conventional teaching was carried out?

Based on the Science Academic Achievement Test results, it indicated that Jigsaw Cooperative Approach had a favourable effect on the pupils' learning. The Independent Samples T-test result for the pre-test indicated that there was no significant difference ($t(68)=1.81$, $p>.05$) between the average pre-test scores for the questions that involved applying and analysing skills in both groups which revealed that the academic success of the groups were similar before Jigsaw and conventional teaching were applied.

Then, the Independent Samples T-test result for the post-test revealed that there was a significant difference ($t(68)=3.90$, $p<.05$) between the average post-test scores for the questions that involved applying and analysing thinking skills in the experimental group and the control group. The mean score of the post-test for the questions that involved applying and analysing thinking skills in the experimental group were higher than the mean score in the control group. This showed that

compared to the pupils in the control group, the pupils in the experimental group were more capable of answering the questions in terms of the applying and analysing skills. This indicated that Jigsaw Cooperative Approach had enhanced the pupils' applying and analysing skills. These results were supported by the earlier studies which reported that cooperative learning was more effective than traditional teaching method in improving pupils' academic achievement (Parveen & Batool, 2012; Karacop & Doymous, 2013). The research results of Parveen and Batool (2012) indicated that the mean score of post-test for experimental group was higher than mean score of post-test for the control group. The results showed that cooperative learning method was superior to traditional method in general science achievement. He also agreed that the pupils' academic performance taught through cooperative learning was better than the academic performance of the pupils taught through the conventional teaching. This was because the pupils in the experimental group were instructed and motivated to assist and learn from each other during the cooperative learning. This was the same with this study where pupils learned and taught each other in groups. Hence, the result of Parveen and Batool's research supported this finding where the mean score of the post-test for the experimental group was significant difference with the mean score of post-test for the control group.

The Paired-samples T-test result showed that there was a significant difference in the Science academic achievement of the pupils in the experiment group and the control group. This revealed that Jigsaw Cooperative Approach and conventional teaching promoted the pupils' learning. Before teaching the Science topics, the pupils did not have prior knowledge on these topics. After the learning process, they had obtained new information and were able to answer the questions in post-test better than the pre-test. In this study, it was found that both conventional

teaching and Jigsaw Cooperative Approach have effect on the Science learning. However, Jigsaw Cooperative Approach has a greater impact. The difference of the mean scores between pre-test and post-test for the experimental group (19.16) was larger than the control group (12.42). The mean score of the post-test for the experimental group was also significantly difference with the mean score of the post-test for the control group. These results revealed that the pupils in the experimental group mastered the applying skill and analysing skill much better than the pupils in the control group.

However, according to the difference of the pre-test and post-test score for the experimental group, there was no large difference in the mean scores. This might due to the content of the test given. All the questions in the test were higher order thinking which pupils required to implement applying and analysing skills to answer the questions. However, there were combination of lower order thinking and higher order thinking questions in the test of previous studies. It was easier to answer the lower order thinking questions compared to higher order thinking questions. This may be one of the reasons why the pre-test and post-test of the experimental group was smaller than the results of other studies. This had also indicated that pupils have to study hard to improve their higher order thinking skills and then only they can achieve better in their learning. These findings supported by the previous studies on higher order thinking (Saido et al., 2018). Saido et al. conducted a study to evaluate the higher order thinking skills (HOTS) level of the 7th grade pupils. The result indicated that the majority of the 7th grade pupils were at lower level of thinking skills. This study proved that almost all pupils needs to develop their HOTS for improving pupils' learning in Science.

The post-test scores of the experimental group was significant difference with the post-test scores of the control group. The pupils in the experimental group had mastered the applying and analysing thinking skills through group activities. During the group discussion, the pupils had applied the skills to solve the problems and make decisions with their peers. The pupils' understanding and the acquisition of the HOTS had increased. After the intervention, they applied applying and analysing skills unaided when questions in Science Academic Achievement Test were answered. This was consistent with the Social Development Theory stated by Le Vygotsky (1978). This was also supported by the past research studies where cooperative learning method were effective to develop pupils' HOTS and the achievement of greater learning outcomes (Altun, 2017).

Altun (2017) had done a mix method study to examine the efficiency of learning plan with the implementation of cooperative learning method. The result revealed that cooperative learning method had a positive effect on learning. According to Altun (2017), cooperative learning strategies supported permanent learning. Pupils carried out the learning of the subtopics at different stages in the cooperative learning process. This was the same with the condition in this study. Cooperative learning can lead pupils to answer higher order thinking questions because pupils are always be trained to answer Socratic questions in information sharing and working for a group task. Socratic questions stimulated their thinking and helped them to grasp and to build logical thinking skills. This was supported by Veldman et al. (2019) who had stated that cooperative learning activities contributed to pupils' high-level talk. High-level talk was characterised by pupils expressing elaborated responses by using higher order thinking skills.

5.2.2 Research Question 2: How are Year Five pupils' cooperative skills when Jigsaw Cooperative Approach is implemented in the Science lessons?

To observe the pupils' cooperative skills when Jigsaw Cooperative Approach is implemented in the Science lessons, observation protocol provided a guideline to the researcher to carry out observation. The researcher also evaluated the pupils' cooperative skills in two cycles by using rubric. The pupils' cooperative skills were discussed based on two themes, these were Positive Interdependence and Face-to-face Interaction.

5.2.2.1 Positive Interdependence

In the First cycle, the pupils showed the improvement in Positive Interdependence in working for a group task process compared to the sharing information process. During sharing information, the pupils did not play their own role. They did not pay attention and treat their group members rudely. Some of them also ordered their group members to work as they did not assign works properly. The pupils improved their cooperative skills in working for a group task. The started to involve actively in group task. The took initiative in group activities, felt interest with group works and accepted each other's opinion.

In the Second cycle, the pupils started to remind the role of each other during sharing information. They also involved themselves actively in sharing information and working for a group task. They felt interest with group activities and respected each other in home group. They discussed the information properly and able to cooperate in the process of building the house model. Compared to the Cycle I, the categories of this theme became more positive in the Second cycle. Each pupil showed their improvement in the process of sharing information and working for a group task in the theme of Positive Interdependence.

The pupils involved themselves more actively from the Cycle I to the Cycle II. At first, they did not take part by answering the questions in group during sharing information. However, they felt interested and took part in group activities in the Cycle II. In the Second cycle, they willing to share their own opinions confidentially, involved their group members in the task friendly and learned together in their group. The study of Zakaria and Iksan (2007) supported this finding. He stated that cooperative learning which involved pupils actively in sharing information and work together to complete tasks given brought effect on pupils' learning.

Furthermore, some pupils did not play their own role as a learner or leader in sharing information. Some of them did not pay attention during group activities and not respected their group members in the First cycle. Then, they always remind the role of each other during learning process in the Second cycle. They also learned to respect each other by listening their suggestions. This showed that pupils improved their cooperative skills through Jigsaw Cooperative Approach. This was supported by Chan, Ong and Mohd Salleh (2016) who carried out a study to examine how Jigsaw cooperative approach influenced Year Five pupils' attitudes towards Science. The results indicated that pupils who had followed through Jigsaw science lessons were more positive in their attitudes towards Science. They found that the increased responsibility towards friends, particularly in terms of assisting each other within a cooperative learning group and the used of Jigsaw cooperative learning increased the student-student interaction in the classroom through discussion in cooperative learning. Johnson and Johnson (2009) also stated that group processing enhanced respect among group members and followed by increasing the commitment of the members to the group, accepted the group norms and contributed to the group success. The findings of this study revealed that group processing ensured each

group member engaged in making conclusion and reflection, participated in group discussion, and evaluated the decisions made by the group members.

Through Jigsaw Cooperative Approach, the pupils learned to work in group and communicated with group members. They made friends with group members during the learning process. So, they reminded the role of each other to make sure that all pupils in group can be succeed together. Hence, more pupils involved in the group activities after the First cycle. This was supported by Qiao and Jin (2010) who stated that Jigsaw Cooperative Learning was able to improve pupils' learning because it was less intimidating for many learners, it increased the number of pupils involvement in the classroom and reduced the competition and made pupils less dependent on the teachers as the expert in the learning environment. This findings also supported by Amedu and Gudi (2017), who investigated the attitude of pupils toward the cooperative learning approach through a quasi experimental research. The data of the questionnaire showed that pupils who implemented jigsaw cooperative method developed positive attitudes significantly. Therefore, they recommended that Jigsaw Cooperative method is suitable to be used in science teaching and the Jigsaw Cooperative Approach has capacity to develop positive attitudes among pupils. Pupils agreed that they get along with other group members during the jigsaw cooperative learning and the jigsaw method helped them to make more friends.

Cooperative learning similar to peer learning. Each group member should responsible for the group success. Therefore, the pupils complemented each other, motivated and corrected other group members' deficiencies. The pupils understood that they were responsible for the group task. This was supported by Johnson, Johnson, Roseth and Shin (2014) who identified that situations characterised by

positive interdependence bought greater motivation and achievement than the negative or no interdependence situations.

5.2.2.2 Face-to-face Interaction

In the First cycle, the pupils seldom encouraged each other during sharing information. They only shared resources with guidance. In the process of working for a group task, they showed progression in face-to-face interaction. They motivated their group members and helped each other to complete the group task.

In the Cycle II, the pupils showed improvement in face-to-face interaction in the process of sharing information and working for a group task in the home group. The pupils encouraged their group members, helped each other and exchanged ideas and resources together without prompting.

The pupils showed their improvement in encouraging their group members when Jigsaw Cooperative Approach had been carried out. In the Cycle II, the pupils encouraged each other when their group members shared their opinions and suggested good ideas. This might motivate the pupils and they were be more confident in sharing their own opinions. This was supported by the research done by Muhammad (2018). The results of his study indicated that the provision of learning methods using Jigsaw Cooperative Learning can affect student motivation and learning outcomes.

Besides, the pupils helped each other to achieve goals. They realised the importance of cooperation. In the Cycle II, the pupils performed excellently in face-to-face interaction where they applied their knowledge and helped their group members to identify the weakness and suggested a better way to make the house model. They also willing to help each other in the process of making the house model. This result was similar with the previous study which was carried out by Lie

(2002). This researcher found that pupils who involved in cooperative learning activities developed interactions skills more readily. During face-to-face interaction, the pupils be able to consider the feelings of others, worked easily in cross-cultural situations, liked their classmates and teachers more than other pupils. According to Kristiansen et al. (2019), the factors of face-to-face interaction that led to successful cooperative learning in small groups were pupils' interpersonal behaviour, experiences, communication and support, and teachers' influence that in turn can lead to deep learning. In this study, the pupils improved their behaviour in the Cycle II such as encouraged each other, helped each other, exchanged ideas together and etc after the implementation of Jigsaw Cooperative Approach. This showed that the pupils' cooperative skills had been improved due to the successful of cooperative learning.

In addition, the pupils shared ideas with guidance during sharing information in the First cycle. The teacher and their peers guided the pupils to understand the Science concept by asking questions. In the Cycle II, the pupils not only shared ideas and resources, they exchanged ideas and resources without prompting during the conversation. This showed that they enjoyed and involved themselves in the learning process. With Jigsaw Cooperative Approach, the pupils developed their own understanding and provided explanations or assistance to group members. Through cooperative learning, the pupils also reorganised and restructured the information that they received and then developed to be more elaborate cognitive understandings (Webb and Mastergeorge, 2003).

Based on the observation, pupils' cooperative skills also had been improved. The results showed that pupils who were weak and moderate in academic achievement improved their skills significantly. For example, Ling and Liew were

moderate academic achievers. Ling prefer learned and listened to the teaching. She seldom encourage her group members in the Cycle I. However, she able to motivate her group members by encouraging them during group activities in the Cycle II. Meanwhile, Liew who was bad tempered and ordered her group members to do the job in the Cycle I was changed her attitude by helping each other during working for a group task in the Cycle II. Jayson and Jun Yi were weak academic achievers. They always keep quiet and do not give any responses during information sharing in the Cycle I. However, Jun Yi was able to help his group members to build the model during experiment. Jayson also helped his group members to build the house model during working for a group task. They showed great improvement in involving themselves in the learning process. Chong and Tan were good academic achievers. They shared knowledge with group members and always guide the group members to complete the task.

Furthermore, the pupils asked Socratic questions which may stimulate the thinking of their group members during group discussion. In Zone of Proximal Development, pupils developed their skills of problem solving under the guidance of adults or with peer collaboration (Vygotsky, 1978). Vygotsky believed that with the guidance of more knowledgeable other, pupils able to achieve task. According to Paul and Elder (2019), Socratic Questioning induced thought in different directions and for many purposes among teacher and pupils or pupils with their peers especially in groups. With the implementation of Socratic Questioning, the pupils exchanged ideas, changed their own minds and learned something new. Hence, the pupils developed their HOTS in the process of sharing information and working for a group task in home group.

Socratic questioning is a tool to assist pupils share and exchange their ideas and thinking through Jigsaw Cooperative Learning. With the implementation of Socratic Questioning in Jigsaw Cooperative Learning in this study, the pupils experienced in-depth theoretical and practical appraisals which can develop their higher order thinking skills. Arase et al. (2016) suggested in his research that researchers and educators in Science education should continuously putting their efforts to explore the best way of implementing the teaching of thinking skills in a Science lesson that would promisingly advance the pupils' capabilities in HOTS. Hence, using Socratic questions in group discussion might assist the pupils to master the Science topics and equip themselves with applying skill and analysing skill.

Through the process of sharing information and working for a group task, it showed that the pupils learned well in the topics of " The Earth, the Moon and the Sun" and "Technology". The topic "The Earth, the Moon and the Sun" was difficult to grasp and the content was abstract to Year Five pupils. Through the group activities, the pupils observed the results of experiments and asked questions when they don't understand the situation. Through the sharing and exchanging of ideas, they learned from each other. They also understood the nature of Science where the contents of the topic "The Earth, the Moon and the Sun" are parts to the daily life. For example, the length and direction of the shadow, day and night, moon phase and etc. For the topic of "Technology", the pupils carried out hands on activity in groups where they had assisted each other. They cooperated and prepared the house model by considering the materials, structure and the shapes for a house model. Learning occurred in this process. The pupils applied the applying skills and analysing skills in this process. Through the asking questions and sharing process, they enhanced their knowledge on this topic.

5.2.3 Research Question 3: What are Year 5 pupils' perceptions on Jigsaw Cooperative Approach as a science learning method?

According to the findings of the questionnaire, 83.34% of the pupils felt happy to learn Science through Jigsaw Cooperative Approach. During the process of learning, pupils communicated and interacted with their group members. During the interaction, the pupils were allowed to talk and to discuss the topics that they were interested within the Science contents with their group members. They had also promoted Socratic questions to guide their group members, applied the Science knowledge of the two topics during group activities and analysed their group members' questions and the group task. For example, Liew asked the questions about viewpoints and perspective to stimulate thinking on how to enhance the strength of the house model among group members. Chong also asked the questions for clarification which aroused pupils' thinking on the factors that influence the strength and stability of the building. After brainstorming, the pupils solved problems and made decision by applying these higher order thinking skills. Hence, they felt this approach caused them felt happy to learn Science. This was supported by Vygotsky (1978), with the social interaction among pupils, their cognition was developed and able to incorporate what they learned from daily life by implementing applying and analysing skills.

Jigsaw Cooperative Approach developed the pupils' cognition as well as HOTS. With the implementation of Socratic Questioning in Jigsaw Cooperative Learning, the pupils in the experimental group had mastered applying skill and analysing skill. This was supported by the research done by Chew, Lin and Chen (2019). The findings of the study revealed that Socratic questioning strategy had provided pupils with a positive and significant support in their HOTS' enhancement.

In addition, 83.34% of the pupils agreed that Jigsaw Cooperative Approach helped them relate the knowledge to daily life. The two Science topics that had been chosen were closely related to our daily life. Hence, the pupils learned to observe the environment such as the astronomy and buildings and applied the knowledge that they learned. It was important because they started to care about the environment and visualised the Universe which was abstract to them. Through the group activities, they solved problems and made decision together by implementing the knowledge that they had gained. The findings were related to the literature review, where the cooperative learning enhanced pupils' thinking skills, problem-solving skills and decision making. (Nezami, Asgari & Dinarvand, 2013, Chatila & Husseiny 2017). Chatila and Husseiny (2017) stated that cooperative learning brought a positive effect to teaching and learning scientific process skills such as observing, predicting, classifying and etc. Cooperative learning improved the learning and practising process of the acquired skills and then promoted the learning of these new skills. The new skills can be used to integrate the knowledge learned into daily life.

Among the statements in the questionnaire, the highest percentage of disagreement was Statement 4, "This approach helps everyone achieve the objectives." and Statement 8, "This approach creates good relationship among group members". A few of the pupils found that not everyone achieved the learning objectives at the end of the lesson. Some of them found that they still do not understood the topic well and it was difficult. This was because the content of the topic on "The Earth, the Moon and the Sun" and "Technology" were abstract and cannot be closely related to Year Five pupils. They seldom use this information in their daily life. These findings were supported by Ha¨nze and Berger (2007) who stated that cooperative learning was more suitable to be used to teach less

challenging topics. Cooperative learning might not promote the feelings of competence among pupils if the tasks were too difficult. A few of the pupils also disagreed that this approach creates good relationship among group members. This was because pupils did not play their own role and were not involved actively in sharing information. Although they showed their improvement in Cycle II, they still disagreed with this statement.

According to the questionnaire, the researcher identified pupils' perceptions on Jigsaw Cooperative Approach from different aspects. One of the aspects was academic learning. The pupils identified that they understood the two Science topics after the implementation of Jigsaw Cooperative Approach. They were able to understand the knowledge of the topics and answer the higher order thinking questions asked by their group members. Their Science Academic Achievement Test score increased after the implementation of the Jigsaw Cooperative Approach. This implied that the pupils had equipped with applying and analysing thinking skills. According to Berger and Hänze (2015), novice pupils' academic performance increased with the quality of expert pupils' instruction by using Jigsaw Cooperative Learning method.

For the aspect of cooperation among the pupils during applying Jigsaw Cooperative Approach, the data of the questionnaire showed that pupils agreed with the statements that they liked to share knowledge with their friends. They also agreed that through this approach, they learned to listen to what their friends said. This created a good relationship between them and they became interested and actively involved in all activities. Tarhan and Sesen (2012) found that pupils believed that Jigsaw Cooperative Learning is effective in promoting positive attitudes and interest, improve interpersonal skills and their learning achievements. The recent research

findings from Johnson et al. (2014) also showed that cooperative learning developed pupils' thinking skills and allowed pupils to interact actively with group members.

The third aspect was the mastering of applying skill and analysing skill after Jigsaw Cooperative Approach was carried out. From the pupils' perceptions, they agreed that they able to organise the content of the topics, use these skills to solve problems, relate the knowledge to daily life, implement the knowledge and able to ask the questions in different ways to receive new information. This was supported by Nejad and Keshavarzi (2015) who stated that cooperative learning, especially think together learn together technique which was used in the study provided a comfortable non-stressful atmosphere and gave opportunities to the pupils to support, encourage, and praise each other through discussion. This promoted the pupils' thinking in a group rather than in a whole class context. The pupils had the opportunities to explore the topics by asking questions with their peers in groups which might promote the mastering of applying skill and analysing skill.

The implementation of Socratic questioning in Jigsaw Cooperative Learning facilitated the learning process through probing pupils' thinking and reasoning in complex problems and structuring a problem-solving process (Rhee, 2007). The observation data showed that with the implementation of Socratic questioning in Jigsaw Cooperative Learning, the pupils improved their cooperative skills such as respect each other, exchange ideas together, provide encouragement and etc. This was supported by Paul and Elder (2019) who stated that Socratic questioning persuaded thought in various directions and for different purposes among teacher and pupils or pupils with their peers especially in groups. This aroused the pupils' interest and they were involved actively in group's learning and thus expanding their cooperative skills and thinking skills.

5.3 Research Implication and Contribution

This study had implication for Chinese national-type primary schools in the aim to develop pupils' HOTS especially applying and analysing skills. The outcome of this research had stated that the Jigsaw Cooperative Approach brought the effects on applying skill and analysing skill among Year Five pupils. The pupils learned to apply and analyse the content of the subtopics during teaching and learning subtopics in their groups.

The implication of this research for the pupils is to enhance the pupils' understandings on these two Science topics. Through the application of Jigsaw Cooperative Approach, the pupils learned higher order thinking skills especially applying and analysing skills during solving problem and making decision. The results of pre-test and post-test of Science Academic Achievement Test showed that the pupils were able to answer the HOTS questions after the intervention.

In addition, the research implication is to increase the cooperation between the pupils. The pupils communicated with group members in the learning process. The effective social interaction boosted the information sharing in groups. The pupils became cooperative and realised their own responsibility in group learning. Hence, they took initiative to involve themselves in discussion and working for a group task. From the results of observation, the pupils who can communicate well were able to cooperate with group members to complete the group task.

Besides, this research also brought implication to the pupils' learning environment. By using Jigsaw Cooperative Approach, the pupils were bring provided with opportunities to propose their opinions and suggestions together with their group members. They had chances to work with friends and not just learning by their own. Then, the pupils had the opportunities to learn how to connect the knowledge

that they learned with their daily life in the process of learning. In the implementation of Jigsaw Cooperative Approach, experiments that had been carried out during sharing information and the task given in groups were closely related to the daily life. This gave the implication to the pupils where Science is fun and is closely related to us in everyday.

This research brought implication to teachers by providing a guideline on how to carry out group activities. To carry out group work, teachers should give clear instructions and make sure each pupil understand their own role in their groups. Jigsaw Cooperative Approach might provide a framework to teacher for implementing the effective group activities. Teacher can refer to the procedures on how to give instructions, ask questions and guide pupils to discuss in groups. Effective questioning and sharing process brought good discussion among pupils.

The research also brought implication for the curriculum executive. The stakeholders might prepare a guideline to teachers stating relevant Science topics that are suitable for the implementation of Jigsaw Cooperative Approach. This is because some of the teachers found that it is difficult to carry out effective group discussion in the classroom. Hence, teacher may refer the guide book and practice this approach in their science teaching process.

This study seeks to contribute experience and new knowledge to researchers about Jigsaw Cooperative Approach among Chinese national-type primary schools. Researcher who intended to study the relationship of the pupils' Science academic achievement with pupils' perceptions on Jigsaw Cooperative Approach as a Science learning method might refer to this study on the procedures of carrying out group activities and the way of collecting data.

Then, this study also contributed to the Social Development Theory that was proposed by Le Vygotsky. Through the interaction with more knowledge other (MKO), pupils learned to share their opinions and suggestion. The teacher and their peers who act as MKO played their role to assist the pupils to become a better learner. Hence, pupils who can do with guidance learned through Jigsaw Cooperative Approach and finally they moved forward where they are able to do unaided. This showed that pupils improved on their own learning process. Pupils practised Socratic Questioning with teacher and their group members. So, they had the ability to promote Socratic questions when they want to receive some thoughtful and relevant responses. Hence, they gained the ability to find the solution and make decision by their own in the future. Finally, pupils in the Zone of Proximal Development can do unaided.

5.4 Suggestions

The following suggestions were made for consideration for future research:

1. This study can be used as a reference to train pupils to develop their understandings through group work activities, especially Jigsaw Cooperative Approach which involve each pupil to teach and to learn from their group members.
2. Further studies can be done to examine the effectiveness of Jigsaw Cooperative Approach on HOTS especially evaluating and creating skills.
3. Interview method should be used in further studies to obtain further knowledge on the pupils' perceptions and their views on the relationship between Jigsaw Cooperative Approach and higher order thinking skills.

5.5 Conclusion

This chapter provides a closing for this quasi experimental research study, as well as a closing for this dissertation. In this study, Jigsaw Cooperative Approach was used in the teaching of the topics, "The Earth, The Moon and The Sun" and "Technology". It was found that Jigsaw Cooperative Approach had favourable effects on the development of the pupils' higher order thinking skills especially applying and analysing skills. If teachers implement Jigsaw Cooperative Learning in the right way and support it with various forms of training or techniques such as Socratic Questioning as what had been done in this study, pupils' higher order thinking skills especially applying and analysing skill can be enhanced.

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