

## **A TEACHER'S PERSONAL REFLECTION ON THE USAGE OF COOPERATIVE LEARNING STRATEGIES IN TEACHING PRIMARY SCHOOL SCIENCE**

By

**Eileen Kee Hui Ling**  
Sekolah Jenis Kebangsaan Chung Hua Engkilili,  
95800 Sri Aman.

### **Abstract**

*This study was carried out to determine how far cooperative learning helped in promoting higher quality of understanding in science subject among 20 high achievers in my class (5K) and how they helped their peers during Science class. 5K class comprised of 47 mixed ability pupils. This study focused on Slavin's classroom organization and Kagan's 6 structures in cooperative learning. After trying out these structures in my Science class, pupils' feedback were obtained. Through classroom observations, pupils' journal writing and interviews, I found that the usage of cooperative learning fulfilled the objectives of this research. In addition to this, I got to know every single pupil better and also their hidden potentials. This study also altered my perception regarding the teaching profession.*

### **INTRODUCTION**

Cooperation is the basic characteristic of human being. Most of our attitudes and values are formed by discussing what we know or think of others. However, it appears that the present educational system seems to emphasize the existence of classrooms with competitive goal structures. In a competitive goal structure, individual competition exists where failure of an individual plays an important role in the success of another. So, instead of helping others, pupils try to "topple" their peers in order to enhance their chances of success.

It is always believed that people working together on a common goal could accomplish more than people working alone. Based on this belief, cooperative learning strategies for classroom use have been developed. Cooperative learning is an approach of instruction in which students in small groups work on specific tasks towards the achievement of a common goal (Slavin, 1987). One of the unique characteristics of the grouping is its heterogeneous nature in terms of ability, ethnicity as well as gender. The tasks are structured such that each member is responsible not only for his / her own learning but also that of his / her peers.

While discussing with each other, cognitive conflict may arise which leads to the development of reasoning skills and higher quality of understanding of the subject. Cooperative learning can help students interact with each other, generate alternative

ideas and make inferences through discussion. Thus, it provides the ingredients for higher thought processes and sets the students to work on realistic and adult-like tasks.

Competition thus exists in a set-up of cooperative learning classroom. There is inter-group competition. Anyway, in cooperative learning, an individual is not the winner. It is the group which loses or wins. The members of a particular group help each other to promote the success of their group members.

According to Slavin (1977), cooperative learning strategies vary in two principal aspects of the classroom organization, that is, task structure and reward structure. In a cooperative learning task structure, students are required to work with one another. These cooperative tasks vary considerably to which they use the cooperative reward structure. Cooperative learning emphasizes on group reward. Group reward provides an incentive to encourage each other and help the group members succeed. Thus, individual accountability is ensured here. Individual accountability ensures that each member puts his/her maximum effort for the group reward. For this, members try to make sure that all have understood the assigned material. Students in cooperative learning value the success of the group so they encourage and help one another to achieve the goal of the tasks assigned.

## **BACKGROUND**

I have been assigned to teach Year 4, 5 and 6 Science classes this year. Among these three classes, 5K posed me the most challenge. It is a big class which consists of 47 mixed ability pupils. Among these 47 pupils, 20 of them are high achievers while 19 of them are average pupils and the other 8 are comparatively slower learners. Based on their previous assessment in school, I noticed that the 20 high achievers scored high marks just by memorizing the facts instead of understanding the subject.

The challenges for me were to help these 20 high achievers have a better understanding of the Science subject, and to help the rest of the 5K pupils perform better in Science subject.

I was actually fed up with the traditional method of teaching Science subject. The "chalk and talk" method did not bring me any satisfaction after teaching Science for three years. The "AAA approach" which was used in my previous action research did come into my mind (Eileen Kee, 2005). But then, the "AAA approach" is not sufficient in helping me overcome my current challenges.

Co-incidentally, I was given the opportunity to attend a training programme on cooperative learning strategies at Institut Perguruan Batu Lintang early this year. This was the first time I came across cooperative learning. It really enlightened me and I realized then that cooperative learning strategies might be the solution to my current challenges. So, I decided to incorporate these cooperative learning strategies into my Science lessons.

## OBJECTIVES

The purpose of this study was to improve my practice in teaching and learning Science among 5K pupils by using cooperative learning strategies instead of the traditional method.

Other than that, this study aimed to determine how far cooperative learning strategies help in promoting higher quality of understanding of Science subject among 20 high achievers of 5K; and how 20 high achievers of 5K helped their peers through cooperative learning strategies (*\* This objective is very important in this action research study because 5K is a big class and I need to make sure every single pupil learn in my Science class*).

### The participants

The participants of this study consist of 47 pupils from 5K class at SJK Chung Hua Engkilili. They are 23 boys and 24 girls in this class. The profile of the pupils in terms of their ability and gender is shown in Table 1.

**Table 1: Profile of 5K Class**

	Low	Average	High	Total
Male	6 (26.1%)	7 (30.4%)	10 (43.5%)	23 (100%)
Female	2 (8.3%)	12 (50%)	10 (41.7%)	24 (100%)
Total	8 (17.0%)	19 (40.4%)	20 (42.6%)	47 (100%)

Among these 47 pupils, 20 of them are rated as high achievers, 19 of them as average pupils while the other 8 are considered as slow learners. The rating is done based on their first Science monthly test result as shown in the Table 2. High ability pupils are those who obtained marks in the range of 80-100 percent (%). Low ability pupils who are considered as slow learners are those whose marks are below 40%. The rest of the pupils are rated as average pupils.

**Table 2: The first monthly Science test result of 5K**

No	Name of Pupils	Marks (%)	Grade	Perceived Science Ability
1	Anne	90	A	High
2	Mei	68	B	Average
3	Phin	70	B	Average
4	Soon	22	D	Low
5	Chi	88	A	High
6	Ping	82	A	High
7	Ling	84	A	High
8	Fung	72	B	Average
9	Tung	65	B	Average

10	Brandon	19	E	Low
11	Yen	78	B	Average
12	Chang	<b>88</b>	<b>A</b>	<b>High</b>
13	Fang	<b>90</b>	<b>A</b>	<b>High</b>
14	Fook	<b>82</b>	<b>A</b>	<b>High</b>
15	Chuan	20	D	Low
16	Easter	52	C	Average
17	Emy	68	B	Average
18	Sia	72	B	Average
19	Grace	<b>82</b>	<b>A</b>	<b>High</b>
20	Helyana	38	D	Low
21	Hii	<b>94</b>	<b>A</b>	<b>High</b>
22	Jacky	<b>88</b>	<b>A</b>	<b>High</b>
23	Lun	15	D	Low
24	Sin	<b>80</b>	<b>A</b>	<b>High</b>
25	Khong	<b>88</b>	<b>A</b>	<b>High</b>
26	San	76	B	Average
27	Pei	68	B	Average
28	Hui	<b>90</b>	<b>A</b>	<b>High</b>
29	Kua	<b>86</b>	<b>A</b>	<b>High</b>
30	Kuon	18	E	Low
31	Lai	74	B	Average
32	Lee	<b>86</b>	<b>A</b>	<b>High</b>
33	Shie	58	C	Average
34	Lily	<b>90</b>	<b>A</b>	<b>High</b>
35	Yik	72	B	Average
36	Wang	52	C	Average
37	Lo	<b>82</b>	<b>A</b>	<b>High</b>
38	Maxwell	28	D	Low
39	Phang	72	B	Average
40	Rina	64	B	Average
41	Sheilla	32	D	Low
42	Hsia	48	C	Average
43	Tay	<b>88</b>	<b>A</b>	<b>High</b>
44	Seng	52	C	Average
45	Wun	<b>82</b>	<b>A</b>	<b>High</b>
46	Tak	<b>84</b>	<b>A</b>	<b>High</b>
47	Watson	60	B	Average

## **METHODOLOGY**

Three methods have been used in data collecting for this research. Classroom observation, journal writings and interviews were used to obtain the necessary data. Data were then transcribed, analysed and coded. Interpretation was made in order to answer the research questions.

### **Classroom observation**

Classroom observation was done while the Science lessons were carried out. During the observation, the responses of the pupils were recorded. Through all these observation, I could keep track of what was actually happening in the classroom. All the field notes written while doing classroom observation were kept as record.

### **Journal writing**

Pupils were asked to write journals to assist me in obtaining feedback from them regarding this research. Journals were written only once at the end of the research study. No guideline was given to them. They were free to express anything in their mind. The journals were written in Mandarin and were then translated into English to keep as a record.

### **Interviews**

Interviews were done informally with 3 pupils upon the completion of the study. Fook, Jee and Boon were interviewed. These 3 pupils were selected to gather further information from them after reading their journal writings. The interviews were conducted one by one with the 3 pupils. The interviews were conducted in Mandarin and were then translated into English.

## **THE ACTION PLAN**

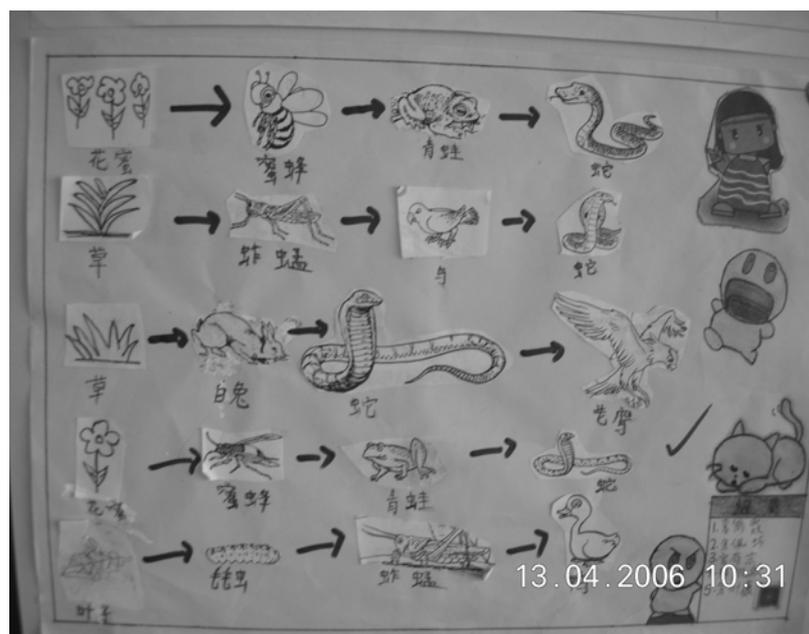
In this study, I tried to incorporate Slavin's classroom organisation on cooperative learning and also Kagan's structures in my Science class. The steps taken were as follows:

- (1) **Forming of groups:** The pupils were placed into heterogeneous groups of 4 or 5. The groupings were done based on their previous academic achievements and abilities as rated by the teacher.
- (2) **Task given:** The teaching phase began with the presentation of the material usually in a lecture - discussion format. This was followed by a problem or a task to be completed.
- (3) **Group work:** Pupils then discussed the material and helped each other to clarify and understand the material. They worked cooperatively with teacher-provided activity sheets. *Think-pair-share* (as described in Appendix 1) was used for this part of the lesson. After every member of the group had agreed on the most workable solution, they shared with the other groups through *team stand and share* (as described in Appendix 1). Activities related to the proposed solutions were tried out at different corners of the classroom.
- (4) **Presentation of outcomes:** The groups were engaged in another cooperative learning structure - *room the room*; *3 stray 1 stay* or *rotating review* (as described in Appendix 1) to present the results of their discussions. Finally, *round robin* or *roundtable* (as described in Appendix 1) was used to summarize what the members of the group had learned from the Science lesson.
- (5) **Rewards:** Rewards were given on the basis of the sum - total of the performances of individual member in the group.

For the purpose of this research, cooperative learning strategies have been carried out for 8 times in 5K class for a period of 2 months. The details of my actions in the form of Lesson Summary are shown in Table 3, Table 4 and Table 5.

**Table 3: Summary of Lesson (1)**

Cooperative Learning (Lesson 1)  Date: 13.4.2006 Day: Thursday Time: 0940-1110 Duration of period: 3 Topic: Food Chain	<ul style="list-style-type: none"> <li>Pupils were placed in groups. They were given a jigsaw puzzle to solve. The jigsaw puzzle showed several food chains in a habitat.</li> </ul>
	<ul style="list-style-type: none"> <li>After that, they were engaged in <b>Think-pair-share</b> to discuss on the relationships between all the animals inside the food chains by looking at the jigsaw puzzle.</li> </ul>
	<ul style="list-style-type: none"> <li>Then, they shared their ideas to the whole class through <b>Team stand and share</b>.</li> </ul>
	<ul style="list-style-type: none"> <li>After that, they were given a task to be completed in each group. To complete the task given, they were given the opportunity to discuss with each other. They were to produce as many food chains as they could with all the pictures that they brought with them. All the pictures were to be pasted nicely on a manila card. No guideline on how to do it was given. They were encouraged to produce something creative. <b>Rotating Review</b> was carried out for this. Here, misconception of science was given attention to. Task outcomes of the pupils are shown in Photograph 1.</li> </ul>
	<ul style="list-style-type: none"> <li>Marks were given to each group for their task outcomes. Degree of cooperation was also considered for this purpose.</li> </ul>
<ul style="list-style-type: none"> <li><b>Round Robin</b> was done to summarize the whole lesson.</li> </ul>	



**Photograph 1: Task outcomes of the pupils (Lesson 1)**  
**Table 4: Summary of Lesson (2)**

<p>Cooperative Learning (Lesson 2)</p> <p>Date: 27.4.2006  Day: Thursday  Time: 0850-1040  Duration of period: 3  Topic: Heat</p>	<ul style="list-style-type: none"> <li>• Pupils were placed in groups. They were given a problem to solve.</li> <li>• Problem: How to make the dented ping-pong round again? They were to do <b>Think-pair-share</b> to solve this problem.</li> </ul>
	<ul style="list-style-type: none"> <li>• After that, they tried out their ideas. While doing that, I tried to explain the concept behind it.</li> </ul>
	<ul style="list-style-type: none"> <li>• Then, they had to design a simple experiment. A candle, a lighter, 2 chairs, some wire, a cup and a spoon were given to them. The understanding of the concept is very much needed here for them to do this. During the activity, they were free to discuss with the rest of the group members. Before they start, the group leader had to make sure that every member of his group had master the science concept of heat. Then, the experiment was tried out in the lab. Photographs were taken for this activity. Photo 2 shows one of the groups doing the experiment.</li> </ul>
	<ul style="list-style-type: none"> <li>• After trying out their experiment, they had to produce a full report. Newsprints and markers were given. Finally, they were engaged in <b>3 stray 1 stay</b> to present the task outcomes to the other groups.</li> </ul>
	<ul style="list-style-type: none"> <li>• Marks were given to each group based on their task outcomes and degree of cooperation.</li> </ul>
	<ul style="list-style-type: none"> <li>• <b>Round table</b> was done to summarize the whole lesson.</li> </ul>



**Photograph 2: Pupils in of the groups trying out their experiment (Lesson 2)**

**Table 5: Summary of Lesson (3)**

<p>Cooperative Learning (Lesson 3)</p> <p>Date: 29.6.2006 Day: Thursday Time: 0850-1040 Duration of period: 3 Topic: The reflection of light</p>	<ul style="list-style-type: none"> <li>I did a simple demonstration in front of the class. I brainstormed with the pupils to gather information on why that happened. They were to do <b>Think-pair-share</b> to solve this problem. I tried to guide them also to the concept that light can be reflected.</li> </ul>
	<ul style="list-style-type: none"> <li>Then, they had to design a simple experiment. An egg, a wok, some water and 12 pieces of rectangular mirrors were given to them. They were supposed to boil the egg using the concept that light can be reflected. The understanding of the concept is very much needed here. They were free to discuss with the rest of the group members. Before they started, the group leader had to make sure that every member of his group had master the science concept. As designing this experiment was quite challenging for them and high thinking skills were required, they were allowed to <b>roam the room</b> to get some ideas from other groups. After that, they tried out their ideas. Photographs taken for this activity are as shown in Photograph 3 and 4.</li> </ul>
	<ul style="list-style-type: none"> <li>After trying out their experiment, they had to produce a full report. Newsprints and markers were given. Finally, they engaged in <b>3 stray 1 stay</b> to present the task outcomes to the other groups.</li> </ul>
	<ul style="list-style-type: none"> <li>Marks were given to each group based on their task outcomes and degree of cooperation.</li> </ul>
	<ul style="list-style-type: none"> <li><b>Round table</b> was done to summarize the whole lesson.</li> </ul>



**Photograph 3: Pupils trying out their experiments (Lesson 3)**



**Photograph 4: Pupils trying out their experiments (Lesson 3)**

## **FINDINGS AND DISCUSSION**

From the feedback that I have obtained from the pupils through their journal writing, I could say that the pupils preferred to have Science lesson this way. They liked me to use cooperative learning strategies in teaching Science. The following quotations are taken from some of the pupils' journal writings.

### **Fang**

*... I like this kind of activity very much...our group members are very cooperative... but then doing all these activities make me sweat a lot... I like science class with this kind of activities...I felt very happy because teacher praised our group just now...*

### **Boon**

*...I like today's activities very much...I enjoy it very much...But then, I dislike my group members. They do not cooperate well with me...*

### **Phang**

*...Everybody took part in the science activities. No one is left out...*

### **Lai**

*Today, I am very happy. A lot of interesting science activities for us. We have group discussion...we work together...Teacher praised our group just now. We all very happy...*

### **Wang**

*...I like science lesson very much. Teacher gives us a lot of interesting activities... I would like to thank our science teacher for making the science lesson a fun one. ...*

**Helyana**

*...I like my group very much. They help me a lot... I like my teacher also. She encourages me a lot...*

**Sin**

*...My favourite subject is Science... Hope to have science lesson every day...*

**Fook**

*...I like science lessons with so many activities...Every science lesson is interesting...We do not just sit down and listen but teacher allows us to walk around... I like this kind of teaching technique...I will make sure our group is the best...*

**Jee**

*...We all work together...my group members do not look down on me... I feel comfortable working with them...*

**Khong**

*...These activities really help me to understand the topic better...*

From these comments, it is evident that the pupils not only gained satisfaction and enjoyed themselves but they are more motivated and interested towards learning Science.

As observed, my Science lessons were totally different from the lessons before. My pupils became very active in the class. Fook wrote about this in his journal. The pupils enjoyed the lessons very much and this could be seen from the smiles on their faces throughout the lessons. Fang, Boon and Fook mentioned this too in their journals.

Feedback from my pupils in the interviews showed that they liked the lessons to be conducted this way as they got the chances to discuss their ideas with their peers, worked out a plan of action with them and sought feedback. They were also allowed to walk around freely instead of just sitting down and listen. This definitely allowed them to learn more than those who just read and listen to lectures. Current research on pupils/ pupils' interaction also showed that pupils/students who 'talk through material with peers learn it more effectively than the students who just read and listen to the material (Johnson & Johnson, 2004).

As I had noticed, when my pupils were given the opportunities to work in various cooperative relationships, they tried their best to develop a strategy on how to study and search for answers to questions/ tasks given. Together with their peers they were able to come out with better ideas. They would not have produced such creative outcomes if they were to work on it alone. Informal interviews carried out with 3 pupils revealed that they preferred to learn in groups rather than learning

alone. Learning in groups make them feel more confident in completing their tasks. As everyone in the group had agreed on the solution, they felt that they would definitely do the things right. In other words, cooperative learning strategies in teaching Science did help in enhancing their thinking in these lessons.

All the members of the group participated actively, talked things through and negotiated meanings for what they learned. As written by Khong in his journal, these Interactions actually help to increase his mastery of concepts in Science. When conflict emerged out of group discussions, they hardly sought my assistance. They preferred to resolve the conflict in their own group. The use of **Think-pair- share, team stand and share, roam the room, rotating review** and **3 stray 1 stay** that involved higher thinking skills were planned and carried out to meet this purpose. With this, they learned and retained more. This will definitely help in increasing their understanding of the Science concepts.

Furthermore, when the 20 high achievers acted as group leaders, they were delegated to explain to their group members how they grasped certain concepts. That would directly address the difficulties the less advanced pupils experienced. In order to do this, full understanding of the concepts were needed before they could actually help the rest of the group members master it. This definitely helped in better understanding of science concepts not only among the 20 high achievers but also the rest of my pupils.

Besides, they learned to value the success of the group and they started to encourage and help one another to perform better in order to make sure their group excelled. Helyana wrote about this in her journal. Those 20 high achievers not only were responsible for their own learning but also were also responsible in ensuring every one in the group knows the material (Henley, 2004). Only with this, I am confident enough to say that every single pupil learned in my Science lessons in this research.

The marks of the following monthly tests indicated that there was a significant improvement on the overall pupils' achievement. This seems to suggest that not only the average and low ability pupils benefited through these cooperative learning strategies but also the 20 high achievers in 5K. They gained better understanding in science concept as they helped their peers during the group activities.

As noticed in my Science class, cooperative learning provides the opportunity for my pupils to learn to work together. The positive peer relationships formed during cooperative learning enhanced their feeling of belonging, acceptance and caring by participating in the groups. According to Phang in her journal, no one was left out. As written by Jee in her journal, her group members really helped her a lot and they did not look down on her although she was just an average student. I am sure she is confident enough to achieve better results in the coming test as she tends to love the group and also the subject. Wang, Fook and Helyana wrote about this. This gives me great satisfaction as I got to know that every single pupil learned in my Science class.

As written too in my field notes, an interesting incident happened while cooperative learning strategies were carried out. Chuan, who was rated as a slow learner happen to face some problems in reading and writing. But he did not want to miss the chance to mix around with his group members although he was not as good as the others. He tried to contribute the little that he had to help the group. Once, while the group was trying out an experiment in the science lab, the water tap started to leak. No one knew how to settle this. Chuan was the one who volunteered to repair the tap. Everyone was so amazed with his talent. What I would like to emphasize here was through cooperative learning, I got to know every single student better and also the hidden potentials inside them such as what was discovered about Chuan.

Other than that, when they were engaged in cooperative structures such as **round robin** and **round table** that were used for the lesson closure, they were encouraged to recall what they have learned and communicate with the rest of the group members. With this, their communication skills (both oral and written communication) were enhanced. This actually helps in preparing them for the future where communication skills are required and necessary.

Anyway, cooperative learning may not be suitable for all pupils. It had been noticed that one high ability pupil, Sin, did not perform well with this strategy. He was not well liked. As what was written in my field notes, *"he yelled at others when their team did not excel."* He may be a student who prefers to learn alone. However, pupils who prefer to learn alone may be in the greatest need of learning the value of cooperation.

Although 5K pupils understanding of the subject and their attitude towards learning Science had improved, some of them, especially the high achiever pupils still compete with each other and they could not work well with others. As written by Boon in his journal, he liked science lesson to be carried out this way. However, he disliked his group members because they did not cooperate well with him. The reason for this may be that the pupils are accustomed to the traditional lecture method. Perhaps they need a longer duration of time in terms of exposure to cooperative learning. This is to shift their orientation in their mind set in order for them to move away from the spirit of competition between them and their peers.

## **REFLECTION**

This study made me realised that cooperative learning strategies actually offered more than I have ever thought before. It provided me with different perception regarding the teaching profession. Before this, I thought that the job as a teacher is just going into the class and do some teaching. The most important thing was to make sure my students understand and score well in their test. Then, we, as teachers would be considered as having done a very good job. Only now, I realised that teaching is not just as simple as this. Besides teaching, we as teachers also have to cater to the pupils' emotional, social and physical needs. It is our responsibility to make sure that our pupils are well-equipped before they step into the challenging world outside the school.

Cooperative learning is proven to be a good method in teaching my Science lessons. It helps to enhance leadership qualities, promotes responsibility and better understanding among the 20 high achievers of 5K. In this research, they acted as group leaders in making sure the learning of Science happen at every corner of the Science classroom. Acceptance and recognition by the other group members surely helped in enhancing the self-esteem of the average and low achiever pupils. The experiences gained while participating in the cooperative learning activities actually trained the pupils to be better learners. As a result, all the pupils performed well in Science subject.

However, cooperative learning may not be suitable for all pupils. Some high achievers such as Sin and Boon might not be performing well with this strategy. They still have the mind set to compete with the rest in the group. With this, they could not work well with others. Perhaps a longer duration of exposure to cooperative learning structures could help them in breaking away from this mind set and assist them to join in the group to make cooperative learning a norm or a culture in learning Science in class.

Recognising the potential of cooperative learning as a good teaching-learning strategy, I would like to take the next step in promoting cooperative learning by applying it to a wider context of school improvement: the cooperative school.

## **BIBLIOGRAPHY**

- Akbar Ibrahim. (2004). *Penyelidikan kualitatif: Satu pengenalan ringkas*. Kuching, Sarawak: PROFES.
- Arhar, J.M., Holly, M.L. & Kasten, W.C. (2001). *Action research for teachers: Traveling the yellow brick road*. Upper Saddle, New Jersey: Prentice-Hall, Inc.
- Bahagian Pendidikan Guru. (2001). *Garis panduan kursus penyelidikan tindakan untuk Maktab/ Institut Perguruan Malaysia*. Kuala Lumpur: Kementerian Pendidikan Malaysia.
- Chuah Kim Hwa. (2006). *Data dalam penyelidikan tindakan dan teknik pengumpulan data kualitatif penyelidikan tindakan*. Materials for Intermediate Stage Action Research Workshop/ Course (Phase 1) Year 2006 under the program Kursus Pendek Kelolaan Institut, Institut Perguruan Batu Lintang, 28-29 March 2006 at MP Batu Lintang, Kuching, Sarawak.
- Chuah Kim Hwa. (2006). *Analisis data kualitatif dalam penyelidikan tindakan*. Materials for Intermediate Stage Action Research Workshop/ Course (Phase 2) Year 2006 under the program Kursus Pendek Kelolaan Institut, Institut Perguruan Batu Lintang, 22-23 June 2006 at PKG Serian, Sarawak.
- Creswell, J. W. (2005). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*. Upper Saddle River, New Jersey: Pearson Education, Inc.

- Eileen Kee. (2005). AAA approach in learning Science among year 6 pupils. In *Prosiding Penyelidikan Tindakan tahun 2005, 3-4 Oktober 2005*, pp. 71-79. Kuching, Sarawak: Maktab Perguruan Batu Lintang
- Ferrer, L. M. (2004). Developing Understanding and Social Skills through Cooperative Learning. *Journal of Science and Mathematics Education in Southeast Asia*, 27(2), 45-61.
- Hajira Bee Abdul Rahman & Michael Liau, T. L. (2000). RESCAM - BAINUN Cooperative School Project. *Classroom Teacher*, 5(1), 61-75.
- Henley, J. (2004). *Cooperative Learning: It's In There!* Retrieved from [www.coe.missouri.edu](http://www.coe.missouri.edu)
- Johnson, D.W. & Johnson, R.T. (1987). *Learning together and alone: Cooperative, competitive and individualistic learning*. Englewood Cliffs, NJ: Prentice Hall.
- Johnson, R.T. & Johnson, D.W. (2004). Encouraging student / student interactions. *Research matters to the Science teacher*. Retrieved from [www.edu.sfu.ca](http://www.edu.sfu.ca)
- Koh Chee Kiat. (2003). Projek Sains dari internet: Suatu cara untuk melatih sikap saintifik dan kemahiran ICT di kalangan pelajar luar bandar. *Bicara Pendidik 2003*, 37-46.
- Marshall, C. & Rossman, G.B. (1999). *Designing qualitative research*. (3<sup>rd</sup> ed.) Thousand Oaks, California: Sage Publications.
- Mary Anne Vaz. (1998). Nourishing the gifted: Balancing the need to belong and the need to grow. *Bicara Pendidik 1998*, 54-66.
- Mary Wong Siew Lian. (2006). *Writing a research paper*. Materials for Intermediate Stage Action Research Workshop/ Course (Phase 2) Year 2006 under the program Kursus Pendek Kelolaan Institut, Institut Perguruan Batu Lintang, 22-23 June 2006 at PKG Serian, Sarawak.
- PALM. (1988-1990). *Supporting teacher development through action research: A PALM resource for advisory teacher*. Norwich: University of East Anglia.
- Pandey, N.N. & Kaushal Kishore. (2003). Effect of cooperative learning on cognitive achievement in science. *Journal of Science and Mathematics Education in Southeast Asia*, 26(2), 52-60.
- Siti Fatimah binti Pg Hj Petra & Cheong I. (2004). A teacher's personal journey in using science projects. *Journal of Science and Mathematics Education in Southeast Asia*, 27(2), 27-44.

Slavin, R. E. (1977). Classroom reward structure: An analytical and practical review. *Review of Educational Research*, 47(4), 663-650.

Slavin, R. E. (1983). *Cooperative learning*. New York: Longman.

Slavin, R. E. (1987). Cooperative learning: Where behavioral and humanistic approaches to classroom motivation meet. *Elementary School Journal*, 88, 29-37.

Toh Wah Seng. (2005). Penyelidikan tindakan: Perkembangan profesionalisme ke arah pengamalan reflektif dan penambahbaikan sekolah. In *Prosiding Penyelidikan Tindakan tahun 2005, 3-4 Oktober 2005*, pp. 1-7. Kuching, Sarawak: Maktab Perguruan Batu Lintang

## Appendix 1

Steps of cooperative learning structures that were used in this research.

### Think-Pair-Share

1. The teacher poses a problem or question(s).
2. Pupils are given 5-10 seconds in which to think of individual responses.
3. Pupils pair with an assigned partner to discuss responses.
4. The teacher calls on several pupils to share their answers with the class.

### Roam the Room

1. The groups discuss to complete the task.
2. When the bell is rung, one of the members of each group is allowed to move freely to any group to get some idea from their discussion silently. No discussion is allowed.
3. After 2 minutes, the bell is rung again. This particular student has to go back to his own group to brief the group what the others are doing.

### 3 Stray 1 Stay

1. The groups discuss to complete the task.
2. The outcomes are pasted on the wall.
3. Signals will be given by the teacher so that 3 members will move to another group together and one member stay in the group.
4. The member that stays in the group is responsible to answer any inquiries given by other group members.
5. When the bell is rung, the 3 members will move to another group again. But this time another member will stay
6. All the 4 members take turn to stay in their own group and answer any inquiries given by other groups.

### Round Robin

1. The pupils sit in groups of 4 or 5
2. Teacher announces a topic or a question.
3. Pupils take turn to share their responses orally.

### Rotating Review

1. Every group is given markers with different colours and manila cards.
2. Task is given to the groups.
3. The groups discuss to complete the task.
4. They are supposed to present their outcomes on the manila cards given.
5. The outcomes are pasted on the wall.
6. Every group is to move together to another group with their markers.
7. They are required to give comment on other groups' outcome. Question mark can be put on it if they do not agree with what is written on the manila cards.

8. Signals will be given by the teacher for every group to go back to their own corner. They have to discuss on the comments given by other and think of a solution to the comments.
9. The groups have to share with the class on the amendments being done.

**Round Table**

1. The pupils sit in groups of 4 or 5
2. Teacher announces a topic or a question.
3. Pupils take turn to write down their responses on a piece of paper.