CHAPTER IV

ANALYSIS OF DATA

Introduction

This chapter analyzes the data collected. Analysis is based on students' responses in the questionnaire administrated as well as the interviews held. Information obtained is shown in the form of frequency distribution and percentage. The interviews were transcribed and analyzed for patterns and relationships.

The main purpose of analyzing the data is to answer the following research questions:

1. What were some basic science concepts that Form Five students used in their 1998 *Reka Cipta* projects?
2. How often did Form Five students use science concepts in their *Reka Cipta* lessons?
3. What were the perceptions of Form Five students on the importance of these science concepts in *Reka Cipta* lessons?
4. What were some problems that Form Five students faced in the application of science concepts in their *Reka Cipta* projects?
5. What were some of the ways that Form Five students used in order to overcome these problems?

Background of Respondents

A total of 96.9% (31) of the students responded to the questionnaire. The respondents consisted of 35% (11) male and 65% (20) female students. The age range of the respondents was from 16 to 18 years. Table 6 shows the frequency distribution of the respondents according to sex.

Table 6: Distribution of Respondents According to Sex

SEX	FREQUENCY (f)	PERCENTAGE (%)
Male	11	35
Female	20	65
TOTAL	31	100

Basic Science Concepts used in *Reka Cipta* Projects

Research Question 1: What were some basic science concepts that Form Five students used in the 1998 *Reka Cipta* projects?

The themes given for 1998 SPM *Reka Cipta* were lighting, separation and protection. Students applied science concepts that were related to these three themes. Table 7 shows the basic science concepts applied by students. Data were collected through Question 4 in the students' questionnaire.

Based on Table 7, among the popularly used science concepts were electricity (42%) , electric current (29%), kinetic energy (29%), movement (26%), light (23%) and force (23%). Besides these concepts, concepts like potential energy (19%), sound (19%), pressure (16%), heat (13%), light energy (10%), chemical energy (10%), refraction of light (6%), temperature (6%),

gravity (6%), gravitational pull (6%), solar energy (3%), dispersion of light (3%), inertia (3%) and pulley system (3%) were also applied by students in their *Reka Cipta* projects. In short, most of the basic science concepts applied in *Reka Cipta* were related to concepts in physics.

Table 7: Basic Science Concepts Applied by Students

SCIENCE CONCEPTS	FREQUENCY (f)	PERCENTAGE (%)
Electricity	13	42
Electric current	9	29
Kinetic energy	9	29
Movement	8	26
Light	7	23
Force	7	23
Potential energy	6	19
Sound	6	19
Pressure	5	16
Heat	4	13
Light energy	3	10
Chemical Energy	3	10
Refraction of light	2	6
Temperature	2	6
Gravity	2	6
Gravitational pull	2	6
Solar energy	1	3
Dispersion of light	1	3
Inertia	1	3
Others: Pulley system	1	3
Reflection of light	0	0
Potential	0	0
Resistance	0	0
Conservation of energy law	0	0

Note: Multiple responses were allowed

Frequency of Science Concepts Application

Research Question 2: How often did Form Five students use science concepts in their *Reka Cipta* lessons?

Table 8 shows the frequency count and percentage of responses for frequency of science concepts application in *Reka Cipta* lessons. The result is based on Question 6 in the questionnaire.

Table 8 : Frequency of Science Concepts Application in *Reka Cipta* Lessons

FREQUENCY	FREQUENCY COUNT (f)	PERCENTAGE (%)
Always	6	19
Sometimes	20	65
Seldom	5	16
Never	0	0
TOTAL	31	100

Table 8 shows that 84% (26) of the students always used science concepts in their *Reka Cipta* lessons. Another 16% (5) seldom applied science concepts however, no student indicated that he/she never applied science concepts in *Reka Cipta* lessons.

In conclusion, majority of the students made use of science concepts in their *Reka Cipta* lessons.

Perceptions of Students on The Importance of Science Concepts

Research Question 3: What were the perceptions of Form Five students on the importance of science concepts in *Reka Cipta* lessons?

Section 1: Table 9 shows the perceptions of students on the importance of science concepts in *Reka Cipta* projects. This result is based on responses for Question 5 in the students' questionnaire.

Table 9: Perceptions of Students on The Importance of Science Concepts in *Reka Cipta* Lessons

PERCEPTIONS OF STUDENTS	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE	TOTAL
Science concepts are not important	0 (0)	2 (7)	15 (48)	14 (45)	31 (100)
Science concepts are needed in order to understand how a project functions	9 (29)	19 (61)	2 (7)	1 (3)	31 (100)
Science concepts assist in invention	14 (45)	14 (45)	2 (7)	1 (3)	31 (100)
I do not need science concepts	1 (3)	0 (0)	14 (45)	16 (52)	31 (100)
Science concepts assist me in explaining how a project functions	8 (26)	17 (55)	5 (16)	1 (3)	31 (100)

Note: Figures in brackets are percentages

Table 9 shows that 93% (29) of the students disagreed and that science concepts were not important. Only 7% (2) of the students felt that science concepts were not important. The table also reveals that 90% (28) of the students agreed that science concepts were needed in order to understand how their *Reka Cipta* projects functioned. The other 10% (3) disagreed with this perception. A total of 90% (28) of the students agreed that science concepts assisted in their inventions whereas 10% (3) disagreed with the statement. A small percentage i.e. 3% (1) felt that he/she did not need science concepts in *Reka Cipta* lessons but the other 97% (30) were of the opinion that science concepts were needed. Majority of the students i.e. 81% (25) agreed

that science concepts assisted them in explaining how their projects functioned. Only 19% (6) seemed to think that science concepts did not assist them in this area.

It can be summarized that the results suggest that majority of the students perceived that they needed science concepts to understand and explain how a project functioned. This is an indication that these students recognized that science concepts played an integral role in *Reka Cipta.*

Section 2: Table 10 shows the perceptions of students on whether science concepts should be taught in *Reka Cipta* lessons. The result is based on Question 9 in the students' questionnaire.

Table 10: Students' Responses to Whether Science Concepts Should be Taught in *Reka Cipta* Lessons

RESPONSES	FREQUENCY COUNT (f)	PERCENTAGE (%)
Strongly Agree	21	68
Agree	9	29
Disagree	1	3
Strongly Disagree	0	0
TOTAL	31	100

An overwhelming majority of the students (97%) were of the opinion that they should be taught science concepts in *Reka Cipta* lessons in school. Only 3% (1) disagreed however, no student strongly disagreed being taught science concepts in *Reka Cipta* lessons. This is an indication that almost all of the students advocated the teaching of science concepts in *Reka Cipta* lessons.

Problems Faced by Students in Application of Science Concepts In *Reka Cipta* Projects

Research Question 4: What were some of the problems that Form Five students faced in the application of science concepts in their *Reka Cipta* projects?

Data for this question were obtained through Question 7 in the students' questionnaire. Table 11 shows that 74% (23) of the students faced problems when applying science concepts in their *Reka Cipta* lessons. The problems faced by students in application of science concepts in their *Reka Cipta* lessons are shown in Table 12.

Table 11: Students' Responses to Whether They Faced Problems When Using Science Concepts

RESPONSES	FREQUENCY COUNT (f)	PERCENTAGE (%)
Yes	23	74
No	8	26
TOTAL	31	100

Table 12: Problems Faced In Application of Science Concepts

PROBLEMS	FREQUENCY f	PERCENTAGE %
I do not understand clearly a few science concepts used	15	48
I often could not think of suitable science concepts	11	35
I could not explain the science concepts used	10	32
science concepts are difficult to apply	9	29
I do not know how to apply science concepts	9	29
I only guess the science concepts used	5	16

Note: Multiple responses were allowed

The most common problem faced by students when applying science concepts in their *Reka Cipta* projects was they did not understand clearly a few of the concepts used. This was cited by 48% (15) of the students. Another problem was students often could not think of any suitable science concepts to be used (35%) i.e. students were not sure what science concepts to use for their projects. Other problems were students were unable to explain the science concepts that they had used (32%), science concepts were difficult to apply (29%), students did not know how to apply science concepts (29%) and they only guessed the science concepts that they could use (16%).

In brief, students found the application of science concepts difficult and they faced various kinds of problems in the application of these concepts in their *Reka Cipta* projects.

Ways of Overcoming Problems

Research Question 5: What were some of the ways that Form Five students used in order to overcome the problems of science concept application in their *Reka Cipta* projects?

Table 13 below shows how these Form Five students overcame the problems they had faced in the application of science concepts in their *Reka Cipta* projects. Data were obtained through Question 8 in the students' questionnaire.

Table 13: Ways to Overcome Problems of Science Concepts Application In *Reka Cipta* Projects

WAYS TO OVERCOME PROBLEMS	f	%
request for the teacher's assistance	24	77
refer to books	23	74
request for friends' assistance	17	55
modify the *Reka Cipta* project so that I can use easier science concepts	12	39
request for parents' assistance	5	16
forget the problem and think of another science concept	2	6
Others: carry out own experiments	1	3

Note: Multiple responses were allowed.

Table 13 indicates that most students overcame problems of science concepts application in their *Reka Cipta* projects by requesting their teachers' assistance. A total of 77% (24) of the students resorted to this solution. Other ways that students used in order to overcome their problems were referring to books (74%), requesting assistance from friends (55%), modifying their projects so that they could make use of easier science concepts (39%), asking help from their parents (16%), putting the problems aside and thinking of other science concepts to use (6%) and carrying out their own experiments to test the science concepts that they could apply (3%).

We can surmise that these Form Five students did face problems in science concepts application in their *Reka Cipta* projects and they used various methods in order to overcome their problems. Assistance from various people was the most sought-after method of solving their problems, followed by other methods such as referring to books, modifying their projects and carrying out experiments.

Results of Interviews

Interviews were carried out randomly on 22.6% (7) of the students. The purpose of the interviews was to gather more detailed information on the problems that Form Five students had faced in relation to science concepts application in their *Reka Cipta* projects and their suggestions on how to overcome these problems.

Basic Science Concepts Applied in *Reka Cipta* Projects

Table 14 shows the basic science concepts applied by students. Data were obtained through Question 2 in the interview schedule.

Table 14: Basic Science Concepts Applied by Students

STUDENT	SCIENCE CONCEPTS USED
1	electricity, sound, electric current
2	photosynthesis, electricity, heat, light
3	electricity, potential energy, gravitational pull, pressure, gravity
4	evaporation, electricity
5	concepts related to electricity
6	electricity, sound, chemical energy, electric current
7	pulley system, gravitational pull, potential energy, force, movement, kinetic energy

Majority of the students that the researcher interviewed i.e. 86% (6 out of 7) applied the concept electricity in their *Reka Cipta* projects. This is consistent with the results of the survey. Other common concepts used were electric current, sound, potential energy, gravitational pull, heat, light, pressure, chemical energy, pulley system, force, gravity, movement and kinetic energy. Most of these concepts were similar to concepts elicited through Section II of the survey (refer to Table 7). Two new concepts, i.e. concepts of photosynthesis and evaporation

were also mentioned in the interviews.

Problems Faced in Application of Science Concepts in *Reka Cipta* Projects

Table 15 shows some of the problems that Form Five students faced in application of science concepts in their *Reka Cipta* projects. Data were obtained through Question 3 in the interview schedule.

Table 15: The Problems Faced in Application of Science Concepts

STUDENT	PROBLEMS FACED
1	1. The electric circuit used was difficult to connect 2. Difficult to think of where the wire board should be hidden 3. Difficult to choose between using the car honk as the alarm or a separate alarm
2	1. Science concepts are difficult to explain 2. Science concepts need detailed understanding 3. Sometimes, it is difficult to explain how the project functions
3	1. I do not understand science concepts in depth 2. Could not use science concepts in the project invented 3. Know the concepts but do not know how to apply them in the project 4. Difficult to come up with suitable science concepts for the project
4	1. Difficult to ascertain the time needed to determine the evaporation rate of the project. 2. It was also difficult to ascertain the electrical power that should be used
5	1. Sometimes I do not know how to apply science concepts at certain parts of the project
6	1. Difficult to apply science concepts in the project
7	1. Difficult to use science concepts in the *Reka Cipta* project 2. Do not really understand the science concepts used

The interviews revealed more detailed problems faced by the students with regards to applications of science concepts in *Reka Cipta*. Table 15 shows that most students faced various kinds of problems in the application of science

concepts in their *Reka Cipta* projects. Majority of the students (57%) faced difficulty in applying science concepts in their projects. Although they might know some suitable science concepts, they were not able to apply them. Explaining the concepts as well as how their projects functioned also posed major problems to these students. Some students did not understand in depth the science concepts that they had used. Most of them felt that a detailed understanding of the concepts was needed.

It is interesting to note that these results complement the responses obtained in Section III of the questionnaire (refer to Table 12).

Ways to Overcome Problems Faced When Applying Science Concepts in *Reka Cipta* Projects

Again, the interviews brought forth interesting findings with regards to students' suggestions and the methods they used in order to overcome the problems they had faced with regards to application of science concepts in their *Reka Cipta* projects. Table 16 illustrates the suggestions given by students in order to overcome the problems. Data were obtained through Question 4 of the interview schedule.

Table 16: Ways to Overcome Problems Faced in Application of Science Concepts in *Reka Cipta* Projects

STUDENT	WAYS TO OVERCOME PROBLEMS
1	1. Do research : read books. 2. Get the help of an electrician outside school. 3. The teacher should teach science concepts in depth, more specifically. 4. The teacher should ask us about the problems we face and help us solve them.
2	1. Ask help from the teacher . 2. Ask friends who are experienced. 3. Go to an electrical shop and request for help from people who are experienced (electricians). 4. Ask the lab assistants for help if the project involves chemicals.
3	1. Get the teacher's assistance. 2. Ask help from friends who are also taking *Reka Cipta*. 3. Look for information from reference books available in the library. 4. Search for information from the computer and Internet. 5. In school now, we only learn science concepts theoretically. To apply these science concepts in an invention is more difficult. So, there should be a special extra class just to teach us science concepts. We need more information.
4	1. Ask the teacher for help. 2. Read our Physics text book or get some reference books from the library. 3. Carry out own experiments (Trial an error).
5	1. The teacher should teach science concepts during *Reka Cipta* lessons. 2. Carry out own experiments using the concepts in order to understand them better.
6	1. Science concepts should be taught in *Reka Cipta* class. 2. Request assistance from the teacher or friends.
7	1. Get teacher's and friends' guidance. 2. The teacher should teach science concepts in depth during *Reka Cipta* lessons.

Majority of the students sought their teachers' (71%) and friends' (57%) assistance when they faced problems in relation to application of science concepts in their *Reka Cipta* projects. Some students made references in the library. Information from the Internet too was obtained. Two of the students

interviewed carried out their own experiments in order to test the science concepts involved, two students went to electrical shops to request for electricians' help and advice and a student asked help from the laboratory assistant in her school.

These findings concur with the findings revealed in Section III of the survey (refer to Table 13). Most students suggested that their teachers taught them science concepts during *Reka Cipta* lessons. There is an indication that *Reka Cipta* teachers offer a special extra class just to teach science concepts and their applications in inventions.

The findings suggest that assistance from various people is again the most popular method of overcoming problems that these students faced, followed by books and the Internet.

Students' Perceptions on the Importance of Science Concepts in *Reka Cipta* Lessons

Section 1: Data for students' perceptions on the importance of science concepts in *Reka Cipta* lessons were obtained through Question 5 in the interview schedule. All of the students interviewed stressed the importance of science concepts for *Reka Cipta*. Various reasons are given as shown in Table 17.

Table 17: Perceptions of Students on the Importance of Science Concepts in *Reka Cipta* Lessons

STUDENT	WHY SCIENCE CONCEPTS ARE IMPORTANT
1	1. Science concepts are important so that we can make a project successfully. 2. We can make a project without science concepts but the project may not be that interesting.
2	1. Science concepts are quite important because many inventions are explained by science concepts 2. We can invent something without science concepts but this is quite difficult 3. We need science concepts to explain how the project functions, why something happens i.e. the process.
3	1. Of course science concepts are important. This is because in our daily lives, whatever that is happening, everything is linked to science concepts. Without science concepts, we will not know what is happening. So, to invent something, we should know science concepts.
4	1. Science concepts are important to determine what we want to make. 2. They are also important to make the project work. 3. Without science concepts, inventing will be more difficult.
5	1. Science concepts are important if the project is related to electric current. You need to understand the conservation of energy law. 2. For the themes lighting, separation and protection, science concepts are quite important. They help you to understand a problem better. They also make it easier for you to think of ideas in order to solve a problem.
6	1. Science concepts are important. We may not be able to invent a project without them. 2. In the themes lighting, separation and protection, science concepts are important.
7	1. Science concepts are important. It is easier to make a project. 2. We can make a project without science concepts but the project may not be that good. It also may not function well.

All of the students interviewed (100%) were of the opinion that science concepts were important for invention. They felt that it was impossible to invent without science concepts as these concepts were needed in order to explain how their inventions functioned. They also perceived that it was possible to invent

projects without applying science concepts, but the projects would be neither that good nor interesting. Students also found it easier to invent if they knew how to apply the science concepts in inventions. The students felt that science concepts were important to think of ways to overcome problems encountered in everyday life. With science concepts, they would be able to come up with ideas for inventing objects that could solve problems faced by mankind.

Section 2: The data obtained through Question 6 in the interview schedule illustrate the perceptions of these Form Five students on the importance of science concepts in *Reka Cipta* lessons. Table 18 shows the perceptions of students on whether science concepts should be taught during *Reka Cipta* lessons.

Table 18: Responses to Whether Science Concepts Should be Taught in *Reka Cipta* Classes and Why

STUDENT	RESPONSES
1	1. Yes. So that we will have in-depth knowledge about science concepts. 2. So that I could use the concepts without any problem.
2	1. Yes. Because most projects require science concepts. These projects need the knowledge foundation. Only then can we invent something.
3	1. Yes, if possible. Science concepts are important in our daily lives. Whatever that is happening depends on science concepts. 2. We can learn everything from science concepts. A lot can be learnt.
4	1. Yes. So that we will have more science concepts to use in our *Reka Cipta* projects. The concepts we have now are quite insufficient.
5	1. The teacher should teach science concepts in *Reka Cipta* lessons.
6	1. Yes, so that it could help me understand science concepts better.
7	1. Science concepts are not taught in *Reka Cipta* lessons. They are only taught in other science subjects. I feel that they should be taught in *Reka Cipta* lessons.

The students' responses and reasons of the responses reveal the importance of science concepts in *Reka Cipta* lessons. These students were of the opinion that they should be taught science concepts in *Reka Cipta* lesson so that they could better understand these concepts. They would also have more science concepts to use in their projects. Moreover, most projects required science concepts.

Summary

It is found that the results of the interviews complement the findings of the survey conducted. Generally, students recognized that science concepts were an integral part of *Reka Cipta* and they would like for the *Reka Cipta* course, particularly the aspect of science concepts and their applications in their projects, to be more effectively taught.