

## CHAPTER II

### REVIEW OF LITERATURE

#### Introduction

This chapter gives a review of literature on the subject of study. It traces the curriculum innovations undertaken by Malaysia from the 1980s to the introduction of the *Reka Cipta* subject. Brief discussions on the *Reka Cipta* curriculum, students' achievement, curriculum evaluation and the importance of students' perceptions in ensuring the success of a curriculum implementation are given.

#### Curriculum Innovations in Malaysia

Curriculum reforms in Malaysia in the 1980s were in accordance with the National Philosophy of Education (Malaysia, 1989). The National Philosophy of Education is based on the recommendations of the Razak Report, Rahman Talib Report, Education Act and Cabinet Committee Report (Malaysia, 1956, 1960, 1961, 1979).

#### National Philosophy of Education

The Malaysian National Philosophy of Education states:

‘Education in Malaysia is an on-going effort towards further developing the potential of individuals in a holistic and integrated manner, so as to produce individuals who are intellectually, spiritually, emotionally and physically balanced and harmonious, based on a firm belief in and devotion to God. Such an effort is designed to produce Malaysian citizens who are knowledgeable and competent, who

possess high moral standards and who are responsible and capable of achieving a high level of personal well-being as well being able to contribute to the betterment of the society and the nation at large.

(translated version: Malaysia, 1989).

#### New Primary School Curriculum

The New Primary School Curriculum or *Kurikulum Baru Sekolah Rendah* (KBSR) was developed following the Cabinet Committee Report (1979). It was introduced in 1982 in 302 project schools and in 1983, launched in all primary schools in the country. KBSR stresses the integrated approach for teaching. It emphasizes the acquisition of 3R's i.e. reading, writing and arithmetic.

#### Secondary School Integrated Curriculum

The Secondary School Integrated Curriculum or *Kurikulum Bersepadu Sekolah Menengah* (KBSM) was started in Malaysian schools in 1988 through a few subjects as continuation of KBSR. In 1989, KBSM was launched for all subjects and was implemented in stages.

In line with the National Philosophy of Education, KBSM aims at integrating the elements of knowledge, skills and values. KBSM emphasizes religious education as well as morality and spirit of citizenship through extra-curricular activities and the use of standard Bahasa Melayu, the national language.

#### Vision 2020 and Education

Vision 2020 was announced on 28 February, 1991 by the Prime Minister, His Excellency Datuk Seri Dr. Mahathir Mohammad. Its desire is to

make Malaysia a fully-industrialised country by the year 2020. The Prime Minister proposed nine challenges whereby one of the challenges to realize this vision is to increase efforts in the field of science and technology. The country should not merely be a 'user' or 'importer' of technology but it should become a 'contributor' to the world's technology advancement (Malaysia, 1995a).

### The *Reka Cipta* Curriculum

*Reka Cipta* was pilot tested in 64 selected schools in Malaysia in the 1994/95 academic year, including 14 at upper secondary level. In 1996, *Reka Cipta* was started in all primary schools and all lower secondary levels. At upper secondary level, the number increased to 104. Table 1 shows the number of pilot schools for the *Reka Cipta* curriculum selected by state education departments.

Table 1: Pilot Schools for *Reka Cipta* Curriculum

| STATE             | LEVEL | USS       | LSS       | PRIMARY SCHOOLS |          |          | TOTAL     |
|-------------------|-------|-----------|-----------|-----------------|----------|----------|-----------|
|                   |       |           |           | NS              | CNTS     | TNTS     |           |
| Perlis            |       | 1         | 1         | 2               | -        | -        | 4         |
| Kedah             |       | 1         | 1         | 2               | -        | -        | 4         |
| P. Pinang         |       | 1         | 1         | 2               | -        | -        | 4         |
| Perak             |       | 1         | 2         | 1               | 1        | -        | 5         |
| Selangor          |       | 1         | 2         | 2               | -        | 1        | 6         |
| Federal Territory |       | 1         | 1         | 2               | 1        | -        | 5         |
| Negeri Sembilan   |       | 1         | 1         | 1               | -        | 1        | 4         |
| Melaka            |       | 1         | 1         | 2               | -        | -        | 4         |
| Johor             |       | 1         | 2         | 2               | -        | -        | 5         |
| Pahang            |       | 1         | 2         | 2               | -        | -        | 5         |
| Terengganu        |       | 1         | 1         | 2               | -        | -        | 4         |
| Kelantan          |       | 1         | 1         | 2               | -        | -        | 4         |
| Sarawak           |       | 1         | 2         | 2               | -        | -        | 5         |
| Sabah             |       | 1         | 2         | 1               | 1        | -        | 5         |
| <b>TOTAL</b>      |       | <b>14</b> | <b>20</b> | <b>25</b>       | <b>3</b> | <b>2</b> | <b>64</b> |

Key: USS = upper secondary schools

LSS = lower secondary schools

NS = national schools

CNTS = chinese national type schools

TNTS = tamil national type schools

(Source: Malaysia, 1995a)

### Preparation

As preparation for the *Reka Cipta* curriculum implementation, several items had been given to schools. Among them are:

#### 1. Curriculum material

- Syllabus and Specification of Syllabus
- Special Guidelines for Reka Cipta

#### 2. Teachers' training

- two teachers from each pioneer school were given in-service training
- teachers had been called for in-service courses several times

#### 3. Allocation

- Launching Grant

- RM1500 each school for Primary 4, 5 and 6
- RM3000 each school for Form 1, 2 and 3
- RM5000 each school for Form 4 and 5
- Per Capita Grant
  - RM5 each student per annum for schools with above 100 students
  - no allocation for lower secondary students
  - RM65 each student per annum for upper secondary students.
- Operation Expenditure
  - courses and training, tracking, meetings, printing and mailing of curriculum materials.

(adapted from: Sabah, 1995)

#### The Rationale for Introducing *Reka Cipta*

*Reka Cipta* is seen as one of the means of realising Vision 2020. At the National Economics Education Seminar on 23 November 1993, Wan Zahid bin Wan Noordin (Malaysia, 1995a), the then Director-General of Education said:

".....in order to become a country with high-technological industries, manpower in the country need to possess strength of mind, be informational, and possess flexible abilities; otherwise the nation would be far behind in world industry competition and this would definitely threatened the desire of becoming a fully-industrialised nation in the year 2020."

Therefore, utmost importance should be placed on the development of manpower in the field of science and technology.

With the realization that education is the vital foundation in order to

realise the vision of becoming a fully-industrialized country, the teaching of science and technology in schools is constantly being upgraded. In fact, the science subject which was abolished years earlier in all primary schools was reintroduced in the 1994/95 academic year (Malaysia, 1994). The *Reka Cipta* curriculum was launched as science and technology had become increasingly more important. *Reka Cipta* is a subject which is able to combine the application of various skills in disciplines such as Science, Mathematics, Art and Living Skills (Malaysia, 1995a).

#### The Objectives of *Reka Cipta*

*Reka Cipta* aims at producing students who are creative, innovative and inventive, as well as able to produce inventions in line with technological and advancement of latest technology towards becoming contributors to the development of the country. It also aims at producing students who think creatively, innovatively and inventively. Students must also be able to invent something beneficial to the country. Emphasis is put on sensitivity to environmental problems and current technology, interest in entrepreneurship and development of the characteristics of an entrepreneur. Moral values such as patience, diligence, inquisitive, competitive and realization of the majesty and sovereignty of God the Creator are not neglected (Malaysia, 1995b). These objectives are in line with the aims and desires of KBSM as well as the National Philosophy of Education.

#### The Status of *Reka Cipta*

*Reka Cipta* is a new topic in the subject Living Skills at primary level, a core component in Basic Living Skills at lower secondary level and a new

elective subject in Group II (Vocational and Technical) at upper secondary level (Malaysia, 1995b; Malaysia, 1996).

Tables 2 and 3 show the status of *Reka Cipta* at lower secondary level.

Table 4 shows the status of *Reka Cipta* at upper secondary level.

Table 2: Subjects Offered at Lower Secondary Level (Form 1 to 3)

|  |
|--|
| <b>CORE SUBJECTS</b>   |
| Bahasa Melayu<br>English Language<br>Islamic Studies/Moral Education<br>Mathematics<br>Physical & Health Education<br>Science<br>History<br>Geography<br>* Living Skills |
| <b>ADDITIONAL SUBJECTS</b>   |
| Chinese Language<br>Tamil Language<br>Communicational Arabic Language  |

Table 3: *Reka Cipta* in Living Skills (Form 1 to 3)

|                 |   |
|-----------------|---|
| <b>CORE</b>     | Manipulative Skills<br>Commerce and Entrepreneurship<br>Family<br>* <i>Reka Cipta</i> |
| <b>ELECTIVE</b> | Additional Manipulative Skills<br>OR<br>Home Science<br>OR<br>Agriculture             |

CORE - taken by ALL students  
ELECTIVE - students choose ONE only

(Source: Malaysia, 1995a)

Table 4: Subjects For Upper Secondary Level (Form 4 to 5)

|                      |
|----------------------|
| <b>CORE SUBJECTS</b> |
|----------------------|

Malay Language  
 English Language  
 Mathematics  
 Islamic/Moral Education  
 History  
 Science  
 Physical & Health Education

|                          |
|--------------------------|
| <b>ELECTIVE SUBJECTS</b> |
|--------------------------|

| GROUP I<br>(HUMANITIES) | GROUP II<br>(VOCATIONAL &<br>TECHNICAL) | GROUP III<br>(SCIENCE) | GROUP IV<br>(ISLAMIC<br>EDUCATION) |
|-------------------------|---|------------------------|------------------------------------|
| Malay Literature 3      | Principles of Accounts 4                | Additional Science 4   | Al-Quran & As-Sunnah Education 4   |
| Literature In English 3 | Basic Economics 3                       | Physics 4              | Syariah/Islamiah Education 4       |
| Geography 3             | Commerce 3                              | Chemistry 4            |                                    |
| Art Education 3         | Agricultural Sc. 4                      | Biology 4              | Tasawwur Islam 4                   |
| Arabic Language 4       | Home Science 4                          |                        |                                    |
|                         | Add. Maths 4                            |                        |                                    |
|                         | Mechanical Engineering Education 4      |                        |                                    |
|                         | Civil Engineering Education 4           |                        |                                    |
|                         | Electrical/Electronic Engineering Ed. 4 |                        |                                    |
|                         | Engineering Design 4                    |                        |                                    |
|                         | Engineering Technology 4                |                        |                                    |
|                         | * <i>Reka Cipta</i> 4                   |                        |                                    |

Note :

1. Students are required to choose 2 - 4 elective subjects from at least 2 groups.
2. Students who choose at least 2 pure science subjects need not take Science.

(Source: Malaysia, 1995a)



### Reka Cipta Content

The main topics in the *Reka Cipta* subject are determination of a problem, brain-storming for ideas, invention of a project, selection of a project, planning a project, construction of a prototype, testing the prototype, upgrading the prototype and documentation (Malaysia, 1995a).

Figure 1 shows the various steps involved in the production of a project. Step I is thinking of a problem. Students are required to identify the needs of consumers or a problem that needs to be solved. Step II involves finding ideas to solve the problem identified by either inventing something new or making modifications. Students are required to think creatively, innovatively and imaginatively to an existing product. Step III involves planning how to implement the idea. Various aspects are taken into consideration including costing. Step IV involves designing various inventions. Designs have to be sophisticated and not stereo-typed. Step V involves identifying of material, equipment and other needs for the invention. Students then proceed to making a systematic, safe, original and neat prototype. The invention will be tested for its function and durability. Students are also trained to market their inventions. Knowledge learnt from Living Skills will be used. Finally, a report will be written and the invention evaluated by the teacher and an examiner.

As can be seen from the nine steps of inventing in Figure 1, the teaching of science concepts is not emphasized.

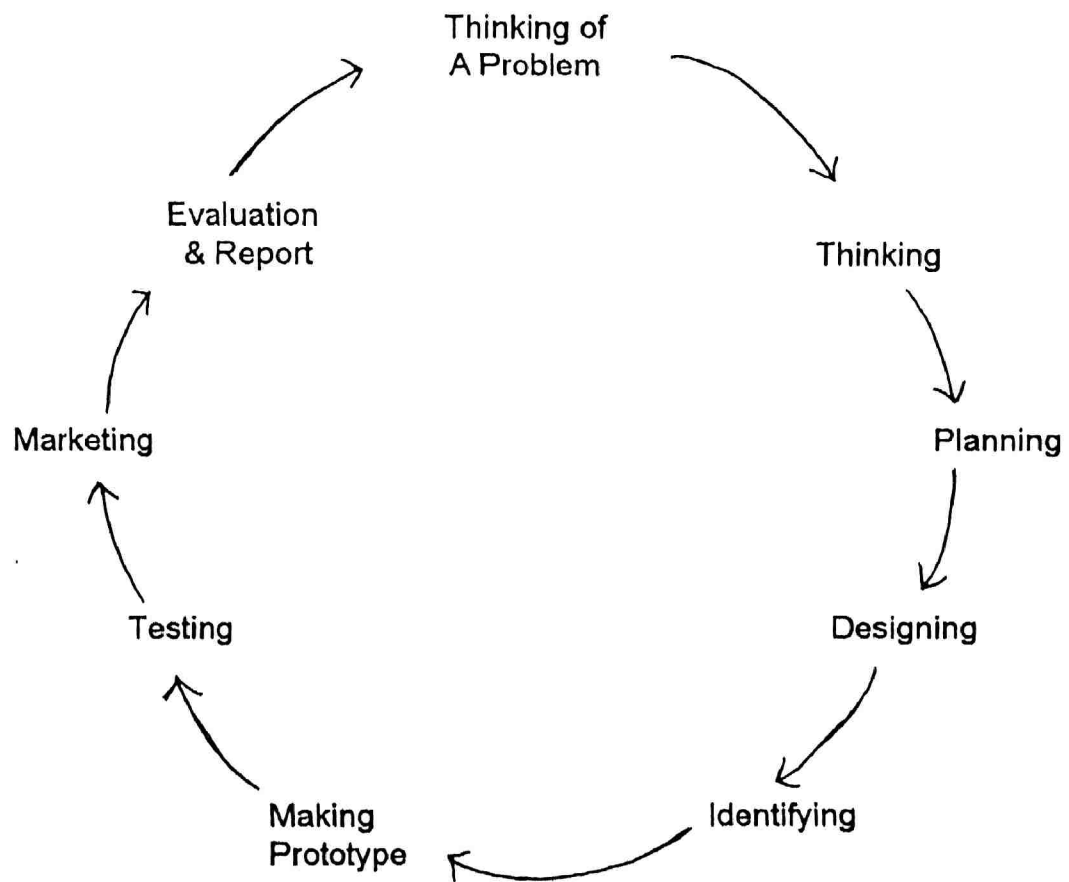


Figure 1: Making An Invention Project  
(Steps In Inventing)

(Source: Malaysia, 1995a)

### Students' Achievement

The *Reka Cipta* paper, with Code 3763, was first offered in the 1996 *Sijil Pelajaran Malaysia* (SPM) examinations. The *Reka Cipta* subject introduces a new approach in evaluation. There is no written examination. Instead, each student is required to produce:

- an artifact and
- a folio.

The artifact should be a product built by a student in the effort of realising his/her invention which strives to solve a problem or needs which has been identified.

The folio is a documentation in the form of notes and sketches which shows the student's ability in inventing and communicating. Besides that, each student also needs to present in 'viva voce' his/her invention to an examiner.

The overall performance of students for *Reka Cipta* in the 1996 SPM examinations was good (Malaysia, 1997b). Students showed high abilities in the use of material, invention techniques and documentation of folios. For the dissatisfactory group of candidates however, their invention products showed that they were not confident in the themes chosen. This resulted in fragile artifacts and weak folios. The aspects of 2D and 3D communication was also not satisfactory (Malaysia, 1997b).

A total of 75.3% of students in the 14 pioneer schools obtained at least a credit in the *Sijil Pelajaran Malaysia* (SPM) examinations whereas the other 24.7% managed to obtain only a pass. The new approach of evaluation used in *Reka Cipta* should be able to produce high performance as the evaluation system does not contain the failure system (Malaysia, 1996a). This is because there is

no written examination and therefore, all candidates should be able to pass the *Reka Cipta* examination as evaluation is based on the folio and artifact each candidate has produced.

Unfortunately, 24.7% of the 1996 SPM candidates only managed to obtain a pass. With such no-failure evaluation system, the researcher wonders at the reasons for the failure of these students to obtain favourable results. Hence, the researcher feels that there is a possibility that science concepts play an integral role in the performance of students in *Reka Cipta* examination.

### Curriculum Evaluation

Curriculum evaluation serves three purposes (Cronbach,1963) :

1. course improvement : deciding what instructional materials and methods are satisfactory and where change is needed;
2. decisions about individuals : identifying the needs of the pupil for the sake of planning his instruction, judging pupil merit for purposes of selection and grouping, acquainting the pupil with his own progress and deficiencies; and
3. administrative regulation : judging how good the school system is, how good individual teachers are, etc.

Curriculum evaluation also serves as a guide to decision-making on the effectiveness of a curriculum (Razali, 1991).

Curriculum evaluation plays two roles. Once an innovation has been developed and accepted, the focus should be directed at its product (Fullan and Pomfet, 1977). Evaluation of the final product of the process of curriculum

evaluation is called a summative evaluation. This kind of evaluation process serves to enable administrators to decide whether the entire finished curriculum has been a success. Summative evaluation serves to improve utilization or recognition of the product and it concerns intervention or support (Scriven, 1967). Besides that, curriculum evaluation is vital in course improvement. It is an important part of the process of curriculum development. Formative evaluation plays a role in the on-going improvement of a curriculum. The role of formative evaluation is to discover deficiencies and successes in the new curriculum. The evaluation feedback serves to improve the product (Scriven, 1967).

Nixon (1992) felt that curriculum evaluation is an attempt to understand and thereby improve educational practice. According to Cronbach (1963),

"The greatest service evaluation can perform is to  
identify aspects of the course where revision is  
desirable."

Cronbach (1963) feels that evaluation, when used to improve the curriculum while it is still fluid contributes more to improvement of education than evaluation used to appraise its final product.

The *Reka Cipta* curriculum was introduced in the 1994/95 academic year. Therefore, this study can be considered a summative evaluation as the curriculum has completed its second year of implementation. However, the curriculum is now only in its third year of implementation. It can be considered still at its infant stage. Therefore, this study can also be a formative evaluation in order to identify the deficiencies and successes in order to improve the

implementation of the curriculum.

The implementation stage is the most critical stage (Siti Hawa, 1986; Gregory, 1993). Problems in implementation may affect the success of a curriculum innovation. Likewise, the *Reka Cipta* curriculum has just been disseminated and therefore, problems of implementation are inevitable. Gross, Giacquinta and Bernstein (1971) found that barriers to the implementation of the innovation at the Cambire School were:

- a) teachers' lack of clarity about the innovation;
- b) lack of the kinds of skills and knowledge needed to conform to the new role model;
- c) the unavailability of required instructional materials;
- d) the incompatibility of organizational arrangements with the innovation; and
- e) lack of staff motivation.

Gregory (1993) also agreed that the lack of skills and knowledge on the part of the teachers contribute to the problems of curriculum implementation. Lynch and Saifellslam (1989) found that the failure of a new curriculum was partly attributed to the factor of teachers' preparation in implementing the change. Several other studies have suggested that the aspect of teachers' preparation determines the successful implementation of a curriculum (Siti Hawa, 1986; Noraini & Rahimah, 1988; Ahmad, 1994). Robiah (1990) and Ahmad (1994) recommended that staff development programme be organized for teachers in order to eliminate anxiety among teachers who would be implementing a new curriculum. This kind of programme would also help instill in these teachers confidence in carrying out their duties in schools.

Another major problem is the unavailability of "highly motivating" and self-instructional material (Gross et al., 1971). Lack of materials, teaching aids, guides, resources, equipment and facilities are also problems cited by researchers (Charlesworth, 1975; Siti Hawa, 1986; Madhavan, 1988; Gregory, 1993). As such, creativity on the part of teachers is vital as there is lack of suitable teaching aids in our schools (Ahmad, 1994). Relevant literature too is vital for teachers' reference (Chelliah, 1986). Chelliah suggested that libraries be constantly upgraded and allocations for libraries should not be reduced at any time.

In order to ensure a successful implementation of a new curriculum such as *Reka Cipta*, factors such as these need to be considered:

1. external and internal support for the change;
2. adequate funding;
3. adequacy of plan for meeting organizational members' needs and the organizational problem under consideration;
4. member acceptance of the need for the change;
5. training of members for new tasks; and
6. the presence of a change agent to give needed support and advice.

(Gross et al., 1971).

In conclusion, curriculum evaluation should be an on-going process. Formative evaluations should be used to evaluate the curriculum at the implementation stage. Through evaluation, the strengths and weaknesses of a curriculum can be determined and steps can be taken to improve its success in future. This also applies to the new *Reka Cipta* curriculum.

### Perceptions of Students

Students' perceptions on the teaching and learning situations should not be neglected. This is strongly suggested by Chiu (1991). According to Weinstein (1983), it is common for students to accept and follow a new curriculum without being given the opportunities to voice the strengths and weaknesses of the curriculum. Weinstein believed that students should be given the role of assisting in the betterment of curriculum since they are the targets of any curriculum. Students should be the ones to give their views.

Ansyar (1982) illustrated the vital role of students' perceptions in ensuring the effective implementation of any new curriculum. He proposed that students' acceptance of a new curriculum be viewed as an evaluation of the curriculum; to be taken into consideration in further reformation if weaknesses existed.

Ruddack (1987) proposed taking into account students' perceptions to create a more meaningful and flexible curriculum. Ghaili (1992) blamed the limited number of studies on the perceptions of students for the failure of a new curriculum.

Students' perceptions of learning and teaching situations in *Reka Cipta* lessons are important. Therefore, these perceptions will be taken into consideration in this study.

### Science Concepts in *Reka Cipta*

Students must be made to realize that science is not restricted to the science room only. Students should be ready to see science, adapt their



knowledge of science and its application to practical situations they meet. Most importantly, apart from pursuing science for its own worth, students should remember science as a service subject to other subjects (Tan, 1990). This is especially relevant to *Reka Cipta* where students actually work on noble products that they themselves invent.

The knowledge and application of science concepts in everyday life and in particularly, *Reka Cipta* lessons, is important. This is clearly stated by a saying,

'I hear and I forget,  
I see and I remember,  
I do and I understand.'

The application of science concepts in inventing an invention or a project (the 'doing' part) in *Reka Cipta* can enhance students' understanding.

Unfortunately, there are limited studies in the area of science concepts application in *Reka Cipta* as the curriculum is still in its initial stage. In their paper entitled '*Robot: Reka Cipta dan Kepentingannya dalam Pendidikan*', Shamsudin, Johari and Badri (1995) proposed inventions in the field of robotics be part of *Reka Cipta* in Malaysian schools. Robotics technology consists of various fields, among them electronics, mechanics, control, intelligence, intelligence system and computer science. It also involves applications of latest discoveries in the field of engineering and technology. According to Shamsudin et al. (1995), the acquisition of the ability to invent a robot means the mastery of various aspects of latest technology. The exciting inventing experience that students may gain would create eagerness in studying the fields of science and technology in greater depths.

A distinctive illustration of the application of science concepts in *Reka Cipta* is found in an action research done by teachers of a secondary school in Sabah under Programme for Innovation, Excellence and Research (PIER) of Educational Planning and Research Department, Ministry of Education, Malaysia. In the action research, Chang, Silva, Rukimin, Teoh and Tan (1996) focused on the applications of various electrical circuits, including those involving motors, relays, timers and power windows by students taking the *Reka Cipta* subject in their school.

### Summary

Based on the discussions in this chapter, it is important to carry out a study in order to:

1. Identify some basic science concepts that Form Five students used in their 1998 *Reka Cipta* projects,
2. Investigate how often science concepts were used in *Reka Cipta* lessons,
3. Identify the perceptions of Form Five students on the importance of these science concepts in *Reka Cipta* lessons,
4. Identify some of the problems Form Five students faced when applying science concepts in their *Reka Cipta* projects, and
5. suggest several ways to overcome these problems.