ENHANCING SCIENCE TEACHING TO RURAL STUDENTS IN TUARAN, SABAH.

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SCHOOL OF SCIENCE AND TECHNOLOGY
UNIVERSITI MALAYSIA SABAH
2011

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THESIS SUBMITTED IN FULFILLMENT FOR THE DEGREE OF MASTERS OF SCIENCE

SCHOOL OF SCIENCE AND TECHNOLOGY
UNIVERSITI MALAYSIA SABAH
2011

DECLARATION

I hereby declare that the material in this thesis is my own except for quotations, excerpts, equations, summaries and references which have been duly acknowledged.

31 March 2010

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DEGREE : **MASTERS OF SCIENCE**

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LIST OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PHOTOS

LIST OF APPENDIX

ABSTRACT

ENHANCING SCIENCE TEACHING TO RURAL STUDENTS IN TUARAN, SABAH.

The study on enhancing Science learning to rural students in Tuaran, Sabah was conducted. Its purpose was to investigate the effectiveness of using a distant learning module in improving the academic performances of rural Tuaran students in Science. The title of the module was called "Light" or "Cahaya" in Malay, containing 29 pages, seven subtopics completed with simple explanations, solo and group experiments, self-test sections and answers to the questions. Two national secondary schools, Sekolah Menengah Kebangsaan (SMK) Badin and SMK St. John in Tuaran district, Sabah were chosen and all students were in Form 2. The results showed overall improvement for each treatment student with module, and also injecting motivation to increase the school performances in Science. Based on the feedbacks given by the students, all of them enjoyed the hands-on activities printed in the modules, and many were inspired to pursue Science courses in universities. As for the retention of information taught two weeks after the module teaching, most treated students could not maintain the same marks they scored, which was a reduction, in the first test. Nonetheless, with proper planning and implementation, modules could enrich Sabah rural students' learning by implying many easy hands-on experiments, to complement the exercises they usually do in classes.

ABSTRAK

Kajian tentang peningkatan mutu pembelajaran Sains di kalangan pelajar-pelajar luar bandar di Tuaran, Sabah telah dijalankan. Ini bertujuan untuk mengkaji keberkesanan menggunakan modul pembelajaran cara pendidikan jarak jauh bagi meningkatkan pencapaian para pelajar dalam Sains di Tuaran. Tajuk modul adalah "Cahaya", yang mengandungi 29 muka surat, tujuk subtopik dilengkapi dengan penjelasan yang mudah difahami, serta eksperimen-eksperimen perseorangan dan berkumpulan, soalan-soalan pengujian kendiri, dan jawapan-jawapan bagi semua soalan. Dua sekolah menengah di bawah naungan kerajaan telah dipilih, iaitu Sekolah Menengah Kebangsaan (SMK) Badin dan SMK St. John di daerah Tuaran, Sabah. Pada masa itu, semua pelajar berada di Tingkatan Dua. Kesemua keputusan menunjukkan peningkatan markah bagi setiap pelajar yang dirawat dengan modul, dan juga diberikan pelbagai jenis motivasi untuk mempertingkatkan pencapaian dalam Sains di sekolah. Berdasarkan komen-komen yang diberikan oleh para pelajar yang dirawat, mereka suka menjalankan semua aktiviti jenis "hands-on" ataupun melibatkan tangan mereka dan ramai yang ingin mengambil kursus-kursus Sains di universiti kelak. Kebanyakan pelajar yang dirawat tidak dapat mengekalkan markah yang sama (pengurangan markah) didapati dalam ujian pertama mereka selepas dua minggu modul diajarkan. Dengan pengaturcaraan yang lebih teratur, modul-modul dapat memperkayakan pembelajaran para pelajar luar bandar Sabah dengan lebih banyak aktiviti secara fizikal, selain daripada aktiviti-aktiviti yang dilakukan dalam kelas oleh guru Sains mereka.

CHAPTER 1

INTRODUCTION

1.1 Scientific Literacy in Malaysia

"Science is all about discovery" (Crow, 2001). Science learning increases economical, political and social growth. As a consequence it is considered a crucial subject in all schools (Thang Siew Ming & Olaybal, 2006). The learning of science and mathematics education began in 1823, when the Raffles Institution was established with a scientific department to teach astronomy, mechanics and botany in Malaya. Textbooks used in schools had been written in England and used foreign examples in their illustrations. Nuffield-based science teaching in schools stareted in 1975 with the content being modified to suit local conditions, but still very much with a distinct British flavor (Cheong et al., 1973; Esther Daniel & Noraini Idris, 2007). The learning of Science is further propagated through correspondence education was introduced in Malaysia as early as 1971, in Universiti Sains Malaysia (USM), Penang. This concept was inspired by the University of London's Foreign Degree Program (Ijazah Luaran), which was done through correspondence, while its exams were conducted with co-operation of the Malaysian Examination Council (Majlis Peperiksaan Malaysia). At the same time, private companies, like "Gaya Pos" were set up to conduct correspondence courses for private candidates of O-Level (Sijil Pelajaran Malaysia), A-Level (or Sijil Tinggi Pelajaran Malaysia), and Lower Certificate Education (Penilaian Menengah Rendah). Thus, correspondence education gives birth to distance education, designed in many ways to reach out and be as close as possible to distant learners (Md. Noor Saleh, 1999).

There are reasons why students, including rural ones, need to learn Science. The first one is to expose and increase scientific literacy (American Association for the Advancement of Science [AAAS], 1989; Bybee, 1997; Brown, Reveles & Kelly, 29005; OECD, 2003; Shwartz, Ben- Zvi, & Hofstein, 2005). The modern science education reform puts more importance on many aspects of Science students. Among them are "scientific understanding…creativity…self-directed learning,

problem-solving abilities, and active engagement with science" (AAAS, 1993; National Research Council, 1996; National Science Teachers Association, 1990, 1990-91).

Secondly, the society needs younger generations of Science students to engage in advanced Science explorations, information dissemination and technological creation. They would also be the ones who could reform the Malaysian Science teaching and learning curriculum, by proposing effective Science study engagement they know since their schooling days. Lastly, students who are trained in Science and Technology are vital assets to the job market. The demand for skilled Science students is crucial to improve humanity's lifestyles. Examples like engineering, astronomy, stem-cells research and nature conservations; these are only some of the fields which require Science-related backgrounds for students who want to specialize when they leave schools (Horan, 1999).

Rural students are constantly facing obstacles when it comes to obtaining formal education. One of the main reasons is poverty. Their parents obtain jobs which offer meager salaries, unlike parents of urban students who are paid with favourable wages and usually highly educated. In turn, when rural parents realized they are not able to earn enough, they would depend on their children to share their responsibilities with, without realizing that formal education could break their poverty cycle in the future. When parents who have little or no formal education emphasize on the present needs, parental encouragement to study would be less, and this causes academic performances of rural students to drop (Boylan *et al.*, 1996). They might also need to miss schooling sessions or drop out to help out their parents.

1.2 Background of Studies

Rural distance education had been implemented in Australia (Stevens, 1994), United States (Barker and Hall, 1994; Lipka and Adams, 2004; Southwick, 2003), Zimbabwe (Siaciwena, 1999) and Indonesia (Raharjo, 1995).

In rural Australia, the distance education concept assists rural Australians easily to educational opportunities, which used to be urban students' golden privilege. Barlow (1922) mentioned that the earliest proof of rural distance education was in the form of correspondence through airmail. The following was one method of reaching to distance learners in hard-to-reach Australian areas by Barlow (1922).

> *… Typed copies of (notes)… and illustrations (graphs, pictures), forming a series of lessons on the most important subjects included in the Primary School Curriculum, are posted each week from the Primary Correspondence School in Brisbane... Typed copies of weekly lessons carefully graded are transmitted with accompanying directions, some intended for the guidance of parents. Written lessons when finished are then returned to the school for correction, comments and further advice. The marked lessons are then returned to the home from which they have been received (Higgins, 1993).*

The above scenario describes a two way communication between the Brisbane Primary School, and the rural learners. The most important part for the learners was to follow exactly what the typed copies, as if the teacher was talking verbally, including answering the questions, and to post back to Brisbane to be evaluated.

The Mongolian distance education for rural and nomadic children was also one of the highlights in a published paper in Open Learning journal by Robinson (1995). She quoted a duo's project for the rural Mongolian children, and the writers mentioned that one must also take into account, to combine several features to get young Mongolians be serious in distance learning. These recommendations may not be used totally in this research, but these could be considered to improve the outcomes in future.

> "*Well-designed learning materials at the appropriate levels; support (materials and people) for parents who themselves should be considered as part of the learning system; thorough…clarification of roles for parents, teachers, students and support staff; training for support staff; some home visits from mobile teachers; some periods of school attendance at suitable times of the year; and above all, speedy feedback on children's questions and assignments. One further factor in retaining the interest of rural children and parents will be the relevance of the school curricula to their lives (Javzankhoorlo and Christensen, 1994)."*

The rural learners' homes are located closer to nature, and would sometimes help out family members who take up traditional jobs, like fishermen, farmers, tree-fellers and so forth. Because of this, the Mongolian educationists came out with something innovative for the distance rural learners, as in the following excerpt:

> "*The creation of more relevant curricula took place through a joint Mongolian-Danish project, for example, the development of a new Natural Science curriculum. (It stressed out) the environments in which Mongolian people live, building on themes such as 'water' or 'energy' (Javzankhoorlo and Christensen, 1994)."*

In Alaska, United States of America (USA), where its publication is the primary source for this research, the researchers produced a personalized Mathematics module for selected Alaskan urban and rural students. This module's central cultural and mathematical theme is the building of a fish rack, a traditional way of drying salmon. The core mathematical concepts related to designing and building a fish rack are similar to any rectangular structure. The module was taught to both control and treated students in a three- to six-week period by volunteer teachers. Then, the students were tested before and after using the module.

A module is a type of book consists of "structured study chapters containing references, activities, and exercises which can be carried individually (Haji Zainal Abd. Latiff et al, 1983)." A module can either be sold or posted to any learners worldwide, provided the language can be understood. Writers could plan their words which should be of "less formal structure than text books, and answers could be provided instantaneously (Haji Zainal Abd.Latiff et al, 1983.)", preferably in the last pages of the module. Modules are commonly used in the college levels, which proved efficacious to the students (Yeazel, 2004; Rajiv Arora & S. Singh, 2006; Kang, J.M, 2002).

Generally, in the USA, distance learning has been established as early as 1992 to 1993 (Barker and Hall, 1994). The most popular type of technology used in USA rural schools, would be the satellite dishes, with the statistics of 73.8 percent (Barker and Hall, pg. 127, 1994). Around 64 percent of distance education technology usages were geared towards enlightening rural USA secondary students, according to the principals interviewed in the journal. Advanced mathematics and science courses were the second most important subjects for the students. Coincidentally, this research, involves disseminating Physics information to rural secondary school students in the West Coast of Sabah, Malaysia, academically and through questionnaires.

1.3 Statement of Problem

In 1999, a report mentioned 21 percent of Malaysians, age 17 to 23, had taken up higher education (Kaur, 1999). Science achievement among rural children for Lower Certificate Examination (Form 3 exams) from 1999 to 2001 is 11.6 percent to 12 percent, while the achievement of Science of rural students from 1998 until 2000 is 14.4 percent to 15.9 percent (Esther Daniel & Noraini Idris, 2006). In 2007, there was a staggering report that 21 percent of Sabahan children, or 448,883 of those above six years old, had never received formal education. Only 50 percent of them managed to continue to secondary education and a disappointing five percent, or 107,115 of Sabahan children studied at tertiary level (United Nations Development Program (UNDP), 2007).

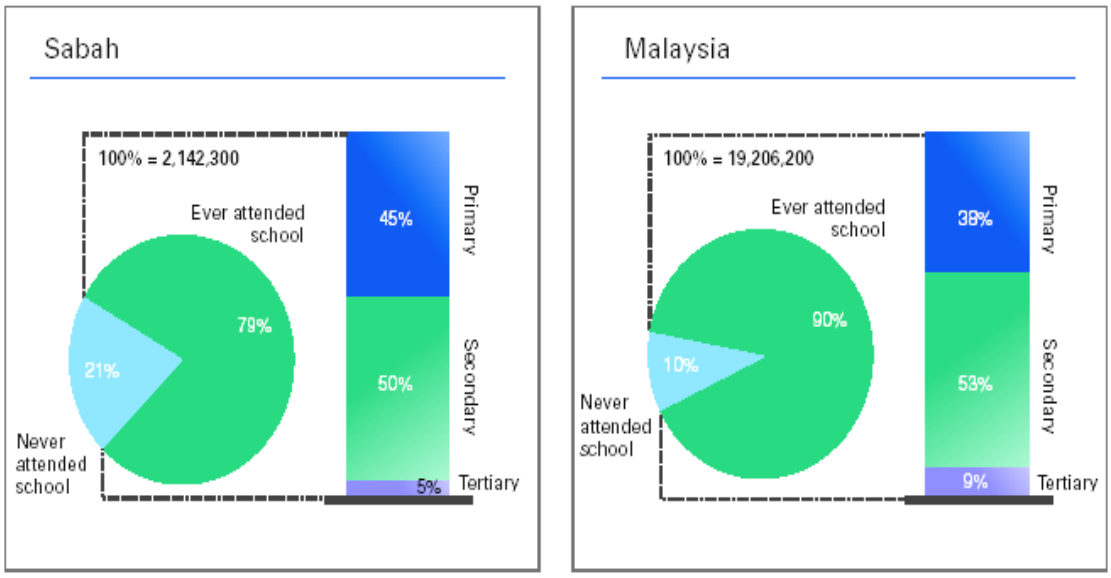

Figure 1.1 Two pie charts, comparing Sabahan and Malaysian children's attainment of education, at age six years old

Source: United Nations Development Program (2007)

The main problem of rural education is the lack of parental participation. Parental encouragement and the home environment generally have often been cited as important factors for academic success. Educationalists and politicians alike lament this fact and have exhorted rural parents to take a greater interest in their children's education. In a study of 16 rural schools, Tengku Ab. Aziz (1989) found that among the background factors which predict the academic achievement of rural children were:

a) Family advantage
b) Students' aspirations,
c) Home environment and
d) Parents' academic support

He also found that parent's involvement with schools was minimal; parents regarded schools as a separate institution and not as part of their world. Only parents whose children were doing well were more interested in the schools.

Generally poor rural parents do not attach much value to education. Due to illiteracy or a very low level of schooling, they are unable to help with their children's school-work. On the other hand, their children are needed to assist them in the rice fields or to do daily chores at home. Thus all too often rural children drop out of school as their parents place a higher value on their immediate needs than on education. Clearly the lack of parental cooperation hinders the progress of rural education, and this should be taken into account by policy-makers and educational planners.

"There is no separate provision for rural education in Malaysia, since the government's overriding objective of achieving national unity has necessitated the implementation of a common curriculum for all schools". (Boylan *et al.*, 1996) What is worse, in the rural areas, where underachievement is still going on, rural students feel, what is the point of studying Science and in schools. Rural students are more interactive; they desire to find out information about life and injecting fun into their environment, despite being impoverished.

When they are being put in schools practicing the current curriculum, they have to just obey their teachers who will disseminate information, and do home works, where the teachers will look for the answers. This in turn, will dampen their spirit of learning, discourage them to have higher ambitions, and worse, they feel like wasting time only in school, when actually, they feel needed to help their parents to work and earn money.

"Generally poor rural parents do not attach much value to education. Due to illiteracy or a very low level of schooling, they are unable to help with their children's school-work. On the other hand, their children are needed to assist them in the rice fields or to do daily chores at home. Thus all too often rural children drop out of school as their parents place a higher value on their basic, immediate needs than on education."(Boylan *et al.*, 1996) Clearly the lacks of parental support, and the lack of higher ambitions by students to improve families' lifestyles, hinder the progress of rural education, and this should be taken into account by policy-makers and educational planners. Higher Education Minister Datuk Mustapa

Mohamed said the number of rural students enrolled in higher institution was negligible, compared with urban students, "only between 20 and 30 students" from one rural village "had made it to university."(The Star, 2007)

1.4 Significance of the Study

This research is vital, to showcase that Science subject, with emphasis on Physical elements is not a mundane subject. In fact, this research will benefit both Science teachers and students who are striving to make the acquiring knowledge process more interesting. There was a research done in Alaska, United States of America (USA) in increasing the Mathematical knowledge of rural students of Yup'ik tribe by encouraging them to build a fish rack while learning Mathematics. This results in the increase of treated students' performance when tested orally (Lipka and Adams, 2004). In Hong Kong, 22 ways were introduced to learn various Physics topics and garnered a very encouraging response from selected students and teachers. For example, to write out as many examples of friction, even until 100, observances of phenomenon that can be viewed in the home toilet, and ten possible consequences of no gravity. (Vivien Mo Yin Cheng, 2004).

Again in the USA, various distance education modes (though more emphasis on two-way videoconferencing courses and online courses) were introduced to enrich the rural students learning, and as a result, the majority who took up distance education to enroll, managed to complete their courses. For example, English, Mathematics (the first two are core subjects) and foreign languages. If distance education, particularly the usage of printed module could be emphasized for rural education, this would greatly motivate them to learn more, as there are so many higher institutions which offer both distance education and on-site courses, like Universiti Sains Malaysia, Universiti Teknologi Malaysia, and Universiti Teknologi Mara (Md.Noor Saleh, 1999).

With the introduction of distance education in the form of a module, the spirit of learning in students would be kindled. They are able to test themselves in written form and revise back easily whichever subtopics they are having comprehension difficulties. They could also be able to carry out experiments with

common yet inexpensive apparatus, and discuss with the module planner at a fixed time if they still could not understand certain topics. Most importantly, it is with high hopes that this proposed module aid in increasing their academic performances and hopes for higher education.

1.5 Objectives of Study

The objectives of this study are:

a) The opinions of treated students about their interest in Science, their Science teachers' roles in their learning and also their methods of learning the subject.
b) Whether a self-study guide or module was able to improve the treated students' results in Science.
c) Whether rewards, though small in quantity, could encourage students, both control and treated groups, to strive to do their best in tests.
d) The responses of students regarding their experiences using the module, what parts of the module needed to be improved and their desire to pursue Science at higher institutions.

1.6 Limitations of Study

a) The study can only be conducted within a limited time, around in one month, because the samples may have extra classes conducted in the mornings, by their own schools. So, the researcher must possess practical pedagogy methods.
b) The study only covers two schools who are studying Science, under the advice of the supervisor. This is because the researcher was doing this study alone, rather than in a group, and using own vehicle to travel to the schools.
c) The research finding does not totally generalize the rural students' performance in Physics/Science. A finding to really get to the roots of performances of rural students may need longer time, larger rural student samples, and using more than one study aid (module).

CHAPTER 2

LITERATURE REVIEW

2.1 Scientific Literacy

Science literacy in someone means that he or she is able to investigate a phenomenon scientifically and to see whether an explanation about the phenomenon is based on facts or otherwise. One also could realize the limitations and the boundaries of scientific knowledge in a discussion or debates. In order for one to achieve high scientific literacy, one must have a positive attitude towards Science to master it well, engage oneself in scientific skills and inculcate values in daily lives. (Kamsah et.al., 2007). It is not surprising that one author by the name of Norjoharudeen (1996) stressed that scientific literacy formation depends on a positive scientific outlook which influences Science learning the most. Research shows that learners are increasingly motivated when they see the usefulness of what are they learning and to apply in their daily lives (McCombs 1996; Pintrich 1996). White (White, 1959) describes how "competence motivation" often translates into a greater amount of time and effort that students are willing to devote to learning. Studies (Duch, 1996; Ferguson 1995; Rennie 1996) that compared student learning and performance on tasks, with and without real-world contexts, revealed that student learning was enhanced by real-life contexts. Schematically, the factors which influence the method of learning as shown below.

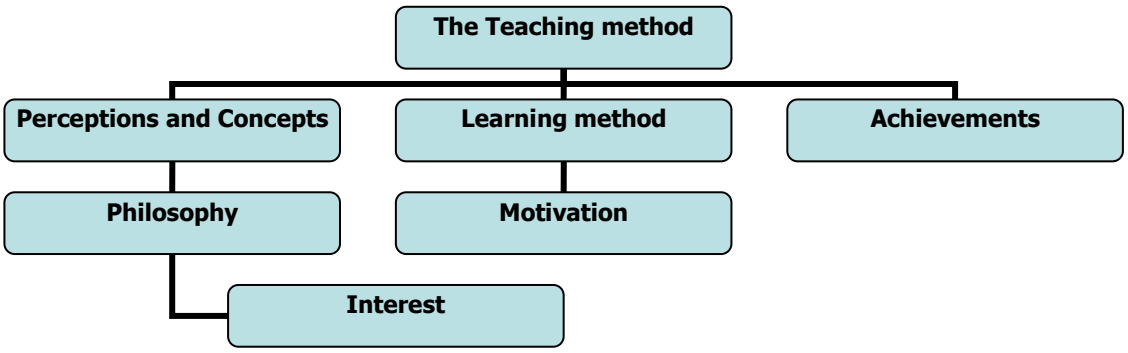

Figure 2.1 Factors which influence Science learning

Khalijah Mohd Salleh (1992)

2.2 Technology and Educational Technology

In this research, technology in science education is used. This is often misperceived with being hooked up on the Internet. According to International Technology Education Association (ITEA), technology has two meanings**.** The first meaning is defined as "human innovation in action that involves the generation of knowledge and processes… that solve problems and extend human capabilities." The second meaning would "involve innovation, change, or modification of the natural environment to satisfy perceived human needs and wants". In short, technology applies anything regarding the human knowledge, to improve the quality of lives of others and also providing job opportunities. Now, let's add the word "educational" to the work "technology", to become "educational technology". It involves human knowledge fused with "multimedia technologies *or* audiovisual aids as tools to enhance the teaching and learning process." (New York State Education Department, 2007).

Educational technology can produce profound effects on students (Bates, 2005). The main group target in this research is the rural students. There is one proof which proves that a teacher's experiences using educational technology inspires school children to perform well in their subject. A group of rural secondary students in Johor, Malaysia took up a subject called "Invention" in 1999 (Ahmad Mohamad Sharif and Kong Meow San, 2001). One of the "Invention" teacher-in-charge, by the name of Mr. Amir Sufari possessed a background of teaching mechanical engineering at a technical school. Besides that, he also attended few training sessions organized by the Malaysian Ministry of Education, for examples S-CAD (a simplified local Computer Aided Design version) and Auto-CAD training; and Course on Robot Kits. His technological experiences, in addition with personal visits to students at their homes, to bring the school works to them, catapulted them to being creative, motivated and as a result, obtained a 100 percent pass in the subject for the SPM (Form Five) examination. Among the projects which earned the students distinctions were:

a) 'Super Brand' for flat dwellers, a clothes-drying device using electromagnets.
b) 'Foldable Carrier', a foldable wheelbarrow using the conveyor system.
c) 'Auto System Fast', a flood detector for home use, using siphon system and