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Technology integrated teaching in Malaysian schools: GIS, a SWOT analysis

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Abstract

Geographical Information System (GIS) has been introduced and widely used in schools in various countries. The year 1990 onwards, the implementation of GIS in schools showed an increase. This is due to the drastic changes and reforms in the education system. Even though the name GIS suits well to the Geography subject, but it is widely integrated in various subjects such as History, Chemistry, Physics and Science. In Malaysia, GIS is common in fields such as risk management, architecture, town planning and municipal department. Anyhow, it is still unknown in the school education system. Even upper secondary students are not familiar with GIS. The Ministry of Education in Malaysia has been continuously reforming the education towards the aim of creating a society based on economic fundamentals and knowledge. The Master Plan for Educational Development with the aim of developing individual potential with well-integrated and balanced education is already on field. Recently, Malaysia invested 18 % of the annual national budget towards upgrading its education system. The computer in education program started in 1999. Three hundred and twenty two schools were chosen as 'break a way' from conventional teaching method towards technology integrated teaching. Projects such as New Primary School Curriculum (KBSR), Integrated Secondary School Curriculum (KBSM), Smart School Project, School Access Centre were introduced constantly. Teacher as the cogwheel of innovations in schools were given courses in aim to develop their ICT knowledge and skill. To this date, the technology integration in subjects is not equal and it disperses through subjects. Geography is one of the 'dry' subjects in schools with less technology which is not preferable among students. Geographical Information System (GIS) is foremost the best Geographical Information Technology (GIT) to be implied in geography subject. In Malaysian Education System, GIS is still exposed just in papers, articles and proceeding papers. Researches had been continuously done in integrating GIS into Geography syllabus. Thus, this article describes and discusses the barriers and opportunities of implementing GIS in schools with a deep focus of how GIS could enhance the process of teaching and learning geography. The purpose of the study is to determine the effectiveness of GIS in enhancing students' interest towards the subject. Barriers that might limit the implementation of GIS in schools also briefly discussed

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in this article. The capabilities of GIS in schools and teaching with GIS is also a part of this article. SWOT analysis is used to find the strength, threaten, opportunities and weakness of GIS to be integrated in Malaysian schools. A content analysis was performed using articles from local and abroad publications regarding technology integration and GIS. Conference proceedings were also analyzed. This content analysis included 35 articles selected from ICT and GIS publication in Malaysia and abroad. The content analysis was done in order to identify the barriers of trying GIS in schools in Malaysia. Thus, this article discusses strengths, weaknesses, opportunities and threatens. The future of GIS in Malaysian Schools has been added into the conclusion.

Keywords: Technology Integration , Geographical Information System (GIS), secondary schools, SWOT analysis, Geography Syllabus

1. INTRODUCTION

The year 1980 onwards could be framed as the 'break a way' from the conventional teaching method with teacher dominant towards a student centered teaching. The New Primary School Curriculum (KBSR) and Integrated Secondary School Curriculum (KBSM) is the first and foremost innovation in Malaysian Education. KBSR was first introduced in 1982 in few trail schools, and followed by the nation wide use in 1983. The recovery program for those who failed to achieve the objective of teaching and learning process is done by the teacher. Special notification was given to students who advanced the teaching and learning process. The use of teaching aids in order to increase the student interest is insisted in these two programs.

The year 1990 addressed another main innovation in the schooling system. The Smart School Program was announced by the government. As one of the Multimedia Super Corridor's Flagship Applications, it aims in capitalizing on leading-edge technologies. In 1999, ninety pilot schools were chosen nationwide to head the technology integration in schools. It became one of the key in fostering the development of a workforce prepared to meet the twenty first century's challenges. The Smart School Program also involves the integration of technology tools which is used as the aid in teaching. Computer remains as the main tutor, tutee and tool in teaching. The Computer Clubs in schools which was introduced in the 1980s been refreshed with this new program. Students are computer literate and could easily develop their knowledge and skill in computer usage. The quantity of computers in schools increased meanwhile the number of ratio for computer – student being reduced.

This was carried with nation school computerization program which started in the year 2002. The purpose of this computerization program is to develop ICT literacy among school students and hence to reduce the digital divide between schools (MOE, 2003). The three stages of this program managed to build computer laboratories in more than 2400 schools (Chan, 2002). Computer Literacy has been introduced as a subject in primary and secondary schools. On the other hand, integration of ICT throughout school subjects with modified curricular insist the usage of computer among teachers and students. ICT based programs and projects have been figured out in year plan in aim to achieve this target. The Education Development Main Plan (PIPP) starting from 2006 until 2010

under the ninth Malaysian Plan is an effort to produce students who are science competent and creative thinkers.

1.1. The Status of Geography in Malaysian Schools

Geography is one of the subjects with least technology integration in Malaysian schools. The teaching method for this subject remains the same which is 'knowledge flow' by the teacher to the students. The 'fact-memorize' system is still the main learning method in this subject. Little changes could be seen, where students will be completing local area study and finally produce a 'folio' as the report of their fieldwork. Yet, a questionnaire remains there whether the students really have done the fieldwork or just copy from the seniors. The basic of geography is introduced in primary schools with standard four students, through the subject 'local studies'. Even though it is not an exam oriented subject, yet students learn to appreciate their live place and things around them.

At the secondary level, geography is a compulsory subject for the lower forms in Malaysian schools. Geography is also included in the Peniliaian Menengah Rendah (PMR), the government examination for the Form 3 students in Malaysia. At Form 4 and Form 5 level, it is an elective subject. Fewer schools offer geography at this level. As the students entered their pre university level, the same situation occurs. Geography is not offered in many schools in form six. Throughout the three years of geography education in lower secondary forms, the one and only computer technology that was integrated in the syllabus is how to produce the bar graph and the line graph using Microsoft Office Excel. The implement of ICT in this subject is quite low. It might be one of the reasons why geography is less popular among students. The lack of geography knowledge among younger generation might lead to a worst situation in future, without a care for the world itself.

The syllabus of Geography is divided into three main fields. Through the first field, Geography Skills, the students learn about longitude, latitude, the usage of compass, bearing, graphs, pie chart, topographic mapping and etc. The second field enhances students to learn about human and physical geography. Topics such as economy activity, population dynamic, transportation and communication were covered in this field. The third field is the local study. Field work will be done by group of students with the guidance of teachers in their local surrounding area. The local study should be done within few kilometers from their school or housing area.

According to Sharifah Norsana (2006), the number of students taking Geography in SPM and STPM level has decreased. Same goes to the result and the pass percentage for this subject in both public exams. Geography has been indicated as a 'hard' subject and is less preferred by students.

1.2. GIS and Geography

GIS is a computer system that captures, stores, manipulates, queries, analyzes and displays geographically referenced data (Marble, 1990). GIS provides more than simply a convenient technique for organizing and retrieving spatial information, it also facilitates the kind of spatial reasoning that supports higher levels of learning among students (Llyod, 2001). According to Fitzpatrick & Maguire (2000), GIS integrates geographic information, computerization, cartographic

and skill in decision making which could be analyzed through GIS software. GIS has been successfully used in various field such as crime investigation, engineering, hydrology, landslide analysis and etc, but education and schools in Malaysia is not exposed to it. Even GIS in education is still new, it has a bright future in coming decades (Longley, 2001).

GIS is still a mile stone far from the education system in Malaysia. Even GIS has been successfully used in various field Anyhow researches and studies have been continuously done to enhance the benefits of GIS in education at various departments and not limited in universities. A few colleges are also involved in introducing and offering GIS courses for school leavers. Even it evolves a small number of students, yet it could be a good starter point for GIS in Malaysian education system.

GIS in schools is still a discussion topic in Malaysia. It is not implemented in Malaysian schools. Anyhow, researches have continuously being done via this topic. GIS is well developed among schools in various countries such as Jamaica, USA and Australia. Even Rwanda with its handful of secondary schools which owns 20 and more computers has been optimistic towards GIS literacy (Foster, 2008). According to Mohd Faris (2006), GIS is manageable to be introduced in schools as almost every secondary school in Malaysia is completed with computer labs and the availability of accessing internet.

A simple way of implementing GIS in local studies that was done by form 2 students has been derived by Vasugiammai & Tarmiji (2005a). Local study is a part of the subject geography which was discussed earlier. The clear picture of how GIS could be implemented in the topic 'The Spread of Settlement' was discussed. Students gathered information regarding the major housing projects around Kepala Batas area. The information includes type of houses, year built, cost and coordinate of the housing project. The information also includes the public facilities such as hospital, fire station, police station and etc. Later, coordinates of each point was added to the digitized map. Attribute data for the points was typed. This finally followed by using query builder, find distance and buffer to get back fast information. GIS provides the best answer for finding housing areas located within 5 kilometers from center of the Kepala Batas town, housing projects which was built within 1990 – 2000, after 2000 and etc.

How GIS could be implemented in teaching geography was illustrated by Rosilawati et al. (2005) within few simple steps. A study was also conducted in applying Open Source GIS to teach Geography for a group of form one students at a secondary school in Kedah. OpenJUMP GIS was used as a teaching aid with several interesting steps handled by the students. A Malaysia map with main mountains was given to the students. They explored the map to find out extended information regarding these mountains and answered questions that were delivered. Pre-test and post-test method was used in this study to notify the result of using GIS in teaching Geography. The result and discussions of the study showed a progress in the post test achievement of the students (Uma Devi, 2008).

2. RESEARCH METHODOLOGY

This research was conducted in a content analysis method. The main focus of the research is to identify the obstacles and opportunities in implementing GIS in Malaysian schools. The performed content analysis uses articles from local and abroad publications including conference proceedings and seminar papers, concentrating on opportunities, threats, strengths and weakness in implementing GIS in schools. A content analysis form was adapted from Crosswell (1991) and used in identifying all the four factors of SWOT analysis. Each article chosen was examined thoroughly in order to identify the SWOT factors. The identified strengths, weaknesses, opportunities and threats were assigned with codes. Later, the identified factors with similar codes were listed together in a form format (Table 1.1). Proofs and findings from previous researches were elaborated and viewed in this article.

2.1. SWOT Analysis

SWOT analysis is a commonly used tool for analyzing internal and external environments in order to attain a systematic approach and support for decision making (Ghazinoory et. al., 2007). The SWOT approach method is based on the aggregation of the internal factors (strength and weakness) and external factors (opportunities and threats). Even the SWOT analysis is considered as an old fashioned and non scientific method of analyzing, it is yet categorized as one of the most common way of strategic planning. According to Johnson et. al., (1989), a SWOT analysis can be simply understood and designed generally to be used in the preliminary stages of decision- making and as a precursor to strategic planning in various kinds of application. A SWOT analysis is an easy and simple technique in decision making.

In this article the SWOT analysis is to identify the four dimensions of status which tightly connects with GIS implementation in schools in Malaysia. The articles reviewed with existing publication conclude few strength, weakness, opportunities and threats for GIS to 'step in' into Malaysian schools.

Table 1 The SWOT Analysis for "GIS in Malaysian Schools"

STRENGTH	WEAKNESS
• Completed computer labs • Increased number of computers in schools • Increased computer knowledge among teachers • Increased computer knowledge among students • Willingness to adapt technological method of teaching / learning	• Internet access is not available to all schools • The ratio of students and computer belonging is still very low • Lack of support from the administrator • Lack of GIS knowledge among teachers • Lack of GIS / Computer knowledge among students • Not included in existing curriculum syllabus • No maintenance of computer labs • Fear of change (conservative)

OPPORTUNITIES	THREATEN
• Support from administrator, GIS vendors • Free Open Source GIS is now available online • Availability of census data • Tutoring through internet / web • Data accessing • Morale / Funding support from teachers and parents association • Geography / GIS faculties in universities could provide training to in-service and pre-service teachers • If exam oriented education system in Malaysia is abolished, GIS could provide skill in order to produce first class human capital • 'learning with GIS' approach	• Lack of data / hard to gain data • High price of GIS software • Insufficient funding • GIS software complexity

2.1.1. Strength of Implementing GIS in Schools

There are a lot of opportunities for Malaysia to enhance GIS in schools. Most of the secondary schools in Malaysia have computer labs. Earlier programs that have been implemented in Malaysian Education System such as Smart School Project, School Access Centre and a few school based IT Projects have succeed in innovating and upgrading ICT tools and components in schools. Teaching Science and Mathematics in English (PPSMI) is one of the gigantic program implemented earlier has vanished a new IT era in schools rather than increasing computer literacy among teachers and students in Malaysia (Nordin, 2006). Most of the earlier researches find out hardware as a highly cost problem because finance is need in preparing computer labs with complete PC sets (Bednarz & Ludwig, 1997; Johansson & Pellikka, 2005). Anyhow for Malaysia situation this is easily overcome by the current computer lab facilities. The computer lab facilities in Malaysian secondary schools were upgraded stage by stage since the year 2000. Even a single computer could be used as an effective teaching and learning aid (Demirci, 2011). A study carried by Demirci (2011) reports that a teacher who taught geography with a single computer in an ordinary classroom could successfully introduce GIS to the students. This Turkish research reveals the number of computers and labs are not barriers in implementing GIS. The same goes with the earlier research done in a Rwandan interior school (Foster, 2008).

According to Habibah & Vasugiammai (2011), the innovativeness and the concept of student-centered teaching and learning method which were the main characteristics of GIS would be warm welcomed by the Malaysian education community. The willingness among teachers who were

teaching with conventional methods to adapt a new technological method should be appreciated. 94.1% out of 219 teachers agreed and made positive statements regarding the implementation of GIS in schools (Nordin, 2006). Even though the number of teachers who were literate in computer in not 100%, the eagerness of learning and applying GIS in their teaching is high.

As an introduction, GIS could easily be adapted into the syllabus that is effective now without any drastic changes in geography syllabus. The component 'local area study' is the brightest chance of implementing GIS in schools. The function of data exploratory, analysis and layout in GIS could be effectively used by students in preparing and producing their study based report (Vasugiammai & Tarmiji, 2005b).

A selected topic of local area study and how GIS could be implemented as a tool for gathering, analyzing and viewing data was carried by Vasugiammai & Tarmiji (2007) in Kepala Batas, a developing area which is located in the northern region of West Malaysia. The result helps the students to identify the growth of the settlement in that particular area within decades. They could study the development among the area phase by phase.

GIS application in teaching and learning process at schools is suitable for both primary and secondary level and not limited with geography subject but could be extended to all subjects (Tarmiji et. al., 2003). Researchers have been done involving primary schools students even at the pre school / kindergarten level in various countries. For Malaysia, introducing GIS at secondary schools may suit well. GIS implementation in geography subject in schools could be an effective platform in upgrading the image of the subject itself at school (Vasugiammai, 2005).

2.1.2. Weaknesses in Implementing GIS in Schools

Common obstacles in implementing GIS in schools are related to technical, institutional, staffing, funding and other factors impacting system development and operation (Crosswell, 1991). The first phase of GIS implementation in Rwandan schools faces the foremost problem regarding the small number of computers owned by the secondary schools (Foster, 2008). Schools without electricity, frequent power outages, infrastructure shortage and lack of knowledge among teachers were listed as the main barriers.

Research conducted in Turkey came with the finding not enough time to complete the task required for the experiment as the biggest obstacle followed by could not find adequate time to prepare their laboratories, lack time to organize students and teach them how to use GIS software (Demirci, 2008). Preparing lab works for GIS is quite a hard job. It took quite a long period for preparing lab with perfect computer access and software, unless there is a lab assistant appointed.

According to Johansson (2002), one of the biggest obstacle (threats) in Finland is lack of in-service training. This was followed by lack of funds for schools and lack of computers and classrooms which is suitable for using GIS. The finding of the survey conducted via email to 219 teachers in Finland is almost similar to the findings of Kerski (2000).

Another research from Johansson & Pellikka (2005) identifies teachers usually find it hard to incorporate GIS into their lessons without supporting curriculum. Time consume is a limit for these teachers to devote themselves in learning this new technology. The same situation parallels with Malaysia. GIS is not included in school curriculum. So the suitability of GIS to be integrated in classroom teaching is limited. It couldn't be integrated in all topics.

The findings of a survey carried earlier in Sabah, regarding the computer literacy among Geography teachers, 54.5% of the teachers have good computer literacy and 40% were at the average level (Nordin et. al., 2003). In implementing GIS in schools, teachers with less skills of accessing computer and IT blinds might be the barrier in succeeding GIS in schools (Tarmiji et. al., 2005a). As we have seen earlier, among universities in Malaysia, only a few offering GIS knowledge and skill throughout their degree. Thus this limited the GIS knowledge among in service and pre service teachers in Malaysia.

The computer knowledge among Malaysian students is also limited. Computer ownership is still low and the access is only in schools. Internet usage is also in minimal among students from rural and sub urban areas. These could cut off the chances of implementing new technology in Malaysian schools. The school administration system in Malaysia is not exposed with GIS. This could also limit the support from them towards the GIS implementation.

2.1.3. Opportunities in Implementing GIS in Schools

Support from GIS vendors such as ESRI has successfully upgraded the use of GIS in various countries. Even the success of GIS in schools in Australia, Turkey, Japan and Rwanda is supported with GIS vendors, especially ESRI.

GIS is capable of being a 'data bank' for schools, where it is not only benefits our upcoming student generation, but also the surrounding society (Tarmiji et. al., 2005a). Gaining data for school use can be gathered by either education department or school itself. At the first phase, it might seem difficult, but once the data were complete, schools could easily update and keep the data for future use.

Free OpenSource GIS is now available online. People can access and use GIS software without any payment. This enhances the chance of implementing GIS in schools.

According to Rød et. al., (2010), a successful GIS implementation should be done evolutionally and not as a revolution. Geography teachers should start with GIS-based web applications and/or free GIS-data viewers. Based on a questionnaire survey among geography teachers in Norway, "teaching with GIS" is found as the best method to introduce GIS to upper secondary students in Norway (Rød, et. al., 2010). Remote Sensing and GIS as a tool for teaching also suits well in Ukraine. Both RS and GIS provide a good source of information in assessing information about the Dianchi Lake (Zhang et. al., 2010).

Many universities in Malaysia have GIS courses. UTM is offering GIS formally through the Degree of Geoinformation (Ruslan, 2002). Most of the universities were offering GIS as papers that carried a

few hours credit, with specification in field such as GIS in spatial analysis, GIS in Location Allocation and etc. Moreover, some the universities were offering GIS papers to the pre-service teacher students. At UMS, for all education program students, GIS is a must. They were offered 2 papers, LGP 1023 (Introduction to GIS) and LGP 4013 (GIS Application) (Mohd Suhaily Yusri et. al., 2006). Other than producing GIS knowledge based teachers, these universities could also help the in-service teachers to gain GIS knowledge by attending weekend courses.

2.1.4. Threats in Implementing GIS in Schools

Gaining data is always becoming a problem in implementing GIS in any organizations (Tarmiji et. al., 2005b). In implementing GIS in schools, centralized data should be provided in order to build a homogenous education curricular throughout Malaysia. The Education Department must guarantee a homogenous data for all schools (Narimah et. al., 2005). If the data is not homogenous, problem may occur in student acceptance of the new technology.

The high price of most GIS software in market will always bend the spread use of GIS. Especially the low funding capacity of school board and community can't afford of owning latest and expensive GIS software. Furthermore, most of the GIS software is consider complex. The complexity of the software has been threatening young adopters in wide use of GIS. In future, if the level of complexity of GIS software is decreased, the chances of wide use of GIS in schools are bright. Students not only from secondary schools, but also primary schools could use GIS easily. According to Croswell (1991), the high ranked complexity of GIS software is limiting the wide use of GIS.

3. CONCLUSION

GIS has a bright chance to be implemented in schools because of its capability of extracting students' interest. Compared with many other audio video visuals and some other conventional method of teaching, GIS has the potency of sharpening the critical thinking among students. It also supports the innovative teaching in the classroom. GIS has the potential to enrich the teaching and learning process which is student centralized. Students can explore on their own to gain information, analyze and finally report their findings. Moreover, the capability of GIS in integrating spatial and discrete data is an ideal term for geography.

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