The Electronic Journal of Mathematics and Technology, Volume 1, Issue 1, ISSN 1933-2823

Mathematics Education and Technology: Past, Present and Future – The Malaysia Experience

Yahya Abu Hasan
ahyahya@cs.usm.my
School of Mathematical Sciences
Universiti Sains Malaysia

Abstract

The realization that an adaptive and educated populace is essential to Malaysia's push for knowledge based economy has led to the adoption of various strategies in the educational sector. Among the many ideas is the adoption of innovative approaches in the teaching learning environment. In this short note, we shall touch upon the history and present use of technology as an aid in understanding and the issues that arise with respect to mathematics education.

1 Introduction

Malaysia is a country mired in paradox; it does not have a tradition of learning as other countries such as China, Japan or England, yet at the same time, it wishes to leapfrog to a developed nation status by the year 2020. Many aspects of Malaysian development plan, such as the present ninth Malaysian plan, are structured to ensure the realization of this dream. The education sector does not escape this push; it is in fact, a target.

The aim of this short note is therefore to highlight Malaysia's role, from humble beginnings and to finally inculcate the use the use of technology in mathematics education. Many ideas and proposals were put forward to fast track the education sector to be in line with those of other developed nations. The stakes and expectations are high. Funding is geared towards training and upgrading facilities. The graduates and school leavers are expected to adapt to the changes taking place and also to perform and contribute to the system in return.

2 The Education System

Formal schooling system essentially started at the time when the country gained independence from the British Empire fifty years ago. The education system is patterned after the British system. Students ages 7–12 attend primary schools and those age 13–17 attend secondary school. These are compulsory years for all. There is a move to make pre-school education

compulsory. If it ever takes place, then small children will start their formal education at age 5. After the last public examination, the student has the option of going straight into the workforce, or goes to high school, or vocational school or matriculation centers. He or she will enter university a year or two later.

In the primary years, the emphasis is on reading, writing and understanding. They are expected to have a working knowledge in at least two languages. In mathematics, the students will learn about numbers, addition subtraction, multiplication and division. They will also learn about basic algebraic relations. In the secondary school, things are not that clear cut. They are various changes to the syllabus. It is also here that some new and innovative techniques are tried. At present there is emphasis on discrete mathematics. Hence we will see subjects like statistics, linear programming being taught. Previously more time being given to mechanics. On the positive side the new subjects require clever usage of software and this can be beneficial in educating the students on the proper use of technology.

3 The Past

In the Proceedings of the First Conference of Asian Technology Conference in Mathematics (ATCM – http://atcm.mathandtech.org) , there was a paper surveying use of microcomputers in the teaching of mathematics in schools in one of the state in Malaysia [Ghazali, 1995]. Half of the schools in the survey do not have even a single computer. Any available computers were used mostly for computer literacy, rather than as an aid in mathematics teaching and learning. This situation more or less can be found in the other 12 states of the country. Hand held calculators were there, but there was no place in the curriculum for an innovative use of this device. Of course technology meant different thing to different people. In schools, there are other technologies that are being used to aid student understanding of mathematics [Hashim, 1998].

Things were not much better in the institutions of higher learning. Many mathematics departments did not have a computer related course let alone a computer laboratory for students. Traditional courses that need the use of computers, such as numerical analysis, were taught from a theoretical point of view. Computers were available, but their uses were restricted to academic staffs and research students.

During that time terms such as World Wide Web did not hold any meaning to most teachers and also to quite a few university lecturers. Administrators, because of the high price of computers at that time, saw computers as a luxury. They find it puzzling, having bought an expensive piece of equipment; an equal amount or more need to be spent to buy software.

Two years later, in 1997, the Second Conference was held in Malaysia. Among the local participants, there were quite a sizeable number from those who have a say in formulating policies. This time around, changes had been taking place. Many were now aware about the existence of the Internet and of its potential usage. They also have an inkling of the use of technology in mathematics education, but a proper exposure to case studies was lacking. Their participation in conferences such as ATCM did much in educating them.

By this time, more schools were equipped with computers. Teachers from selected schools were sent for training in the use of new hardware and software. Again, since the syllabus did

not include the use of these technologies in formal teaching, any computer related courses were carried informally. The use and development of computer-aided instructions software were carried out. The better-equipped schools were involved in these types of activities. In the majority of schools, it was still pencil, paper, and blackboard type of instruction.

In the universities, things were moving at a faster pace. Many mathematics departments now had computer laboratories. Syllabuses were revised to incorporate the computing aspects of mathematics [Ismail, 1997]. Students have access to the Internet, although on a limited bases. Some departments taught students the use of total environment software such as Matlab in mathematics. In other words, there was a concerted effort in making curriculum contemporary. The old problem still exists however; many still have a hard time convincing the administrators to set aside funds for software purchasing.

Many things came out of the second conference. For many, it was the first exposure to the graphing calculator and its potential use. Calculator graphic interest groups were formed, initially in the universities. There were many discussions on how to best to include this in the school and university syllabuses. At that time it was the hope of these groups that the relevant authorities will be more sympathetic towards curriculum reform in the school system.

4 The Present

The second time the conference was hosted in Malaysia, it was the year 2002. In the intervening years from 1997 to 2002, many changes took place. Information Technology is now one of the priorities on the government's agenda. In schools, vast amount of resources were being put into getting the school children IT-aware. The growing yearly universal availability of technology tools provides a grand opportunity to assist teachers in teaching well and in improving the mathematics experience of students. Teachers were trained in use of many software, from Geometers Sketchpad to AutoCad. There are a few centers, such as Regional Education Centre for Science and Mathematics (RECSAM) in the state of Penang, where experts from abroad were invited to give tutorials to local instructors.

There were a few changes to the school syllabus, but not as extensive as many hoped. Sophisticated hand held calculator is now standard among secondary school students. The use of CAD/CAM software is found in certain syllabus streaming. Changes also took place in the tertiary education system.

There were eleven ATCM conferences since 1995. From conferences such as these, many case studies of others experience in applying technology to teach mathematics were collected. From this point of view, the approach has reached a mature state. In Malaysia, many changes took place between then and now.

School children, especially from the urban schools, and university students are very technology aware nowadays. Pupils from schools in the year 2005 are more computer literate than the undergraduates in 1995. The Internet has been a great source of ideas for teachers and the pupils doing projects. They are learning how to use mathematics and understanding the ideas behind it too. For example, two years ago, in a mathematics project competition for secondary school students in a particular state, the winning team used elements of graph theory and software to chart the routes needed to be taken by a taxi in going to certain hotels in a Malaysian

city. The Internet has empowered them to learn graph theory from several websites. There are many other examples where the Internet and the proper use of software are enriching the mathematical experience of school children.

Nowadays, every school must have at least a computer laboratory. Over the last three years, the authorities have supplied graphic calculators to selected schools in Malaysia to explore calculator efficacy in teaching and learning of mathematics. Special projects were set up by educationists to assist school children in helping them to have a better grasp of fundamental ideas of mathematics using the graphic calculator [Idris, 2004]. There are many success stories from these projects.

Against this we find that in school, examinations overshadow everything. There is a public examination in the sixth year, ninth year and eleventh year of schooling. Performance in the examinations is all-important for the children and school alike. With this being the priority, teachers are sometimes reluctant to spend time doing things that are not examinable. Teachers are more concerned in finishing the syllabus and helping the children understand the examination 'system'.

In centers of higher learning, the outlook is brighter. We consider the case of Universiti Sains Malaysia. We believe this represent a typical center of higher learning in Malaysia. Software such as Matlab, Mathematica, SAS and others are available to complement courses in pure mathematics, applied mathematics, statistics and operations research. There is even a course based entirely on graphing calculator [Ali, 2004].

5 The Future

If spite of the nice scenario pictured above, there are problems; there is a digital divide. Schools in the rural areas to a certain extent have not benefited much from the intrusion of technology in mathematics as compared to schools in urban areas. In most cases the school children have no access to computers outside of the school. Internet wise, there is no connection for some of the schools. Some of these problems are slowly being addressed. Whatever it is, there need to be proper training of teachers to enable them to teach well and to properly use the technology to assist school children in their understanding of mathematics.

A more serious problem is the preparedness of the school leavers and university graduates in entering a workplace which is forever changing. In the new economy that is being mapped out, there is a great need for a workforce that is adaptable, creative and innovative. The school system produced students who are very good at doing examinations. Give them a problem not from a textbook and they will be lost. To overcome this, the Education Ministry has looked at the possibility of relying less on examinations as indicator of performance. There is a move to have constant assessment beside the year end examinations. In this situation there is an opportunity for greater use of technology in the teaching learning process.

Another idea that is being seriously considered is giving more emphasis on the development of soft skills. These skills are not easy to defined, let alone taught. Examples of these skills are communication, listening, problem solving and creative skills. Here mathematics and technology can play a part. Mathematics is about posing problem and how to solve it. Surely, these are desirable soft skills. With flexibility in the curriculum, it may lead to a paradigm shift in

mathematics education.

6 Conclusion

In conclusion, much has changed in Malaysia over the last ten years. Mindsets have changed. There is a lot of enthusiasm nowadays. More than a few school children feel at ease using what was a few years ago advanced and sophisticated software. University graduates bring the tools that they learned into their workplace. It takes a lot of efforts by many to arrive to where we are now. Of course there are still problems and unresolved issues, but the hope is that these will slowly disappear. At the same time, the authorities are taking proactive stand to changes in society and the economy of the future.

7 References

R.M.Ali, L.K.Kor; Students' Reactions to Learning Mathematics with Graphing Technology, in Proceedings of the Second National Conference on Graphing Calculators, 1-20, USM Publication (Penang) 2004. M.Ghazali; A Survey Into The Use of Microcomputers in The Teaching of Mathematics in Penang Secondary Schools, Malaysia. in Proceedings of The First Asian Technology Conference in Mathematics, 177-183 , NIE (Singapore) 1995. Y.Hashim; Teaching Technology (in Malay), Fajar Bakti Publication (Kuala Lumpur) 1998. A.I.Ismail, A.H.Yahya, A.W.Jusoh, A.Z.Talib; Introducing and Enhancing Computing Techniques and Tools in an Undergraduate Mathematics Program, in Proceedings of The Second Asian Technology Conference in Mathematics, 54 – 59 PPUSM Publication (Penang)1997 N.Idris; Exploration and Entertaining Mathematics: Why Graphic Calculator?, in Proceedings of the second National Conference on Graphic Calculators, 45 – 54 , USM Publication (Penang) 2004.