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「教與學數碼化」狀況研究
A Study on Information Technology in Education: Teaching and Learning

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Information Technology in Education: Teaching and Learning

Summary Report

In 1998, the Government announced an "Information Technology for Learning in a New Era: Five-year Strategy – 1998/99 to 2002/03", which outlined a blueprint for Information Technology (IT) Education reform. The past five years have witnessed the start and integration of IT into learning and teaching. In March 2004, the Government issued another Consultation Paper, "Information Technology in Education – Way Forward" which identified its vision on the use of IT for the future.

The sophistication and development of Information Technology has resulted in new ways to access knowledge. The use of IT in Education offers opportunities for new approaches and challenges to teaching and learning. This raises the question whether the use of IT enhances the effectiveness of teaching and learning for both teachers and students; and whether the use of IT facilitates the effectiveness of interactive learning. More importantly, with the rapid development of IT, what is the future of IT in education? This study has been conducted through (1) the sending of questionnaires to school subject Panel Chairs; (2) an opinion survey of Hong Kong secondary students; and (3) interviews with educators and specialists. It is hoped that this Study will provide a clearer picture of the issues and will result in recommendations to the authorities concerned.

The self-administered questionnaire was conducted between 19 and 30 April 2004. By systematic sampling, 463 questionnaires had been sent out to school subject Panel Chairs of all the local secondary schools. 118 questionnaires were returned, yielding a response rate of 25.5%. Within the secondary curriculum, 14 main subjects were selected, including Chinese, Chinese History, Chemistry, Biology, Geography, History, Physics, Arts, English, Music, Economy/Government and Public Affairs, Integrated Science, Mathematics and Physical Education.

The Survey was conducted between 19 and 22 April 2004. By random sampling, 514 Hong Kong secondary students were successfully polled, yielding a response rate of 33%, with a standard error of $\pm$ 2.2%. Two focus group interviews with secondary students were also conducted, with a total of 14 youth, 10 males and 4 females participating. In addition, 8 scholars and experts were interviewed between April and May 2004.

Discussion

To seize new opportunities associated with the advance of the technology age, the SAR Government has been arduously engaging in promoting information technology in education so as to pave the way for our youth to enter the digital age in the 21st century. Over the past 5 years, there have been profound changes in information technology in education. In order to better understand the development of information technology in education, we conducted a study on the use of information technology in teaching and learning.

There are 4 main areas in terms of the application of information technology in education. First, the ability to master information technology (IT Literacy); second, a set of techniques for mastering information technology - including searching, assessing, organizing, analyzing and presenting information - and for nurturing the attitude and ability for life-long learning (Information Processing); third, providing instant interactive teaching and learning through the help of information technology (Interactive Learning); fourth, fostering interactive communication and a culture of sharing through platforms (Sharing).

Based on the above understanding, we have conducted a study that includes a telephone survey, a self-administered questionnaire and interviews. The following is a summary of our observations.

1. This Study shows that students and teachers have a fair understanding of information technology and the application of information technology has had an impact in classrooms. This means there is a solid foundation for the further development of information technology in education.

The respective survey results sought by means of telephoning Hong Kong secondary students and responses by their teachers to questionnaires demonstrate a similar level of self-assessed literacy on information technology for students and teachers. Both students and teachers are relatively competent in “handling electronic mail”, “using computer word processing programs”, “finding information via Internet search engines” and “using PowerPoint”. This shows both students and teachers have a certain level of understanding on basic information technology. On the other hand, 82.1% of students and 71.2% of teachers do not feel difficult to apply information technology in learning or teaching.

According to a telephone survey of Hong Kong secondary students, 35.0% say their teachers often present class materials by means of multi-media and 32.9% use computers during classes. Moreover, 28.4% usually compile class information by using information technology.

According to a questionnaire survey of Hong Kong secondary teachers, 40.7% say they often conduct classes with the help of computer and nearly 30.0% make use of multi-media in organizing class materials. These two surveys show that the use of information technology has become popular inside and outside of the classroom. Furthermore, 54.2% of the interviewed teachers think students have shown more initiative in learning through information technology; similarly, 51.7% say they themselves are more motivated when teaching with the help of information technology.

The above shows that both students and teachers have a basic understanding of information technology, and the application of information technology has shown its impact in our classrooms. This positive sign of the use of information technology provides a good foundation for the further development of information technology in education.

2. Both students and teachers play crucial roles in the effective implementation of information technology in education. Our study shows that the initiatives demonstrated by the students and teachers are important stimulating forces to the development of information technology in education.

Among the students, about 80% to 95% of those interviewed agree that the use of information technology can enhance their abilities to gather information (94.5%), boost their interest in learning (87.7%), cultivate a sense of cooperation among classmates (86.5%) and increase their ability in self-learning (81.9%). Moreover, about 70% of students agree the use of information technology enhances their problem-solving skills (77.8%), improves their understanding of sophisticated concepts (67.1%) and develops their thinking skills (66.9%). Finally, when asked to give a score indicating the benefits of promoting information technology in education, the students give an average rating of 6.86 out of a full score of 10.

The survey with the teachers shows similar results. About 60% to 80% of those interviewed agree that the use of information technology can improve the quality of

teaching materials (79.7%), increase the effectiveness of teaching (75.4%), enhance their interest in teaching (69.5%) and make class preparation more efficient (61%). When asked to rate the effectiveness of using information technology in teaching, the teachers give an average score of 5.98 out of 10.

Most of the interviewed students and teachers, have regarded the pace of promoting information technology in their schools as “fair”. This shows that students and teachers are in general satisfied with the progress made in the development of information technology in education.

The two surveys show both students and teachers have a positive attitude towards information technology in education and praise the effectiveness of applying information technology in teaching and learning. This is a welcome finding since the support of students and teachers is vital in the development of information technology in education in our schools.

3. **Most of the interviewed teachers do not feel their authority being overshadowed by the advance of information technology in education. This shows that our teachers are confident with their professional knowledge and skills. A majority of teachers have come to assist their students in the process from the search of “information”, to the realization of “knowledge”. However, only 10% have played an active role in this regard on a regular basis. Therefore, there is much room left for our teachers to assume a more proactive position as “vanguard of knowledge” in the quest for an information technology-based education.**

Information technology in education shifts the focus of education from being teacher-oriented to a more interactive and student-oriented approach. This means that (1) teachers are no longer the only source of knowledge as students can now reach the information source directly; (2) teachers have become mentors of students in searching information and extracting knowledge; and (3) both students and teachers are engaged in an interactive process of learning and teaching whereby teachers play a pivotal role as facilitators.

Among the teachers, 79.7% say their professional authority is in no way threatened by the emergence of information technology in education with only 15.3% indicating such a feeling. This shows our teachers are generally confident in their

professional role.

Moreover, a majority of teachers have come to assist their students in the process from the search of “information” to the realization of “knowledge”, including organizing, analyzing and adjudicating information, as well as transforming information into theories and concepts pertinent to the subject matters. However, less than 10% of teachers have played an active role in this regard on a regular basis. Therefore, there is much room for our teachers in assuming a more guiding role in their students’ quest for knowledge.

On the other hand, in interviews with experts and scholars, one scholar comments that teachers should take the initiative in strengthening their own intellectual abilities and knowledge base, alongside enhancing students’ learning interest and thinking skills in the course of promoting information technology in education. Accordingly, the point is not how much the teachers know about information technology, but how much they know about their own subjects.

The extent of the role played by teachers, the way in which information technology is utilized for teaching purpose and teachers’ own knowledge base are therefore factors having a direct impact on the development of information technology in education.

4. The study finds that deficiencies in four areas - IT literacy; assessment and examination; research and development on software; provision of resources and assistance - are potential barriers for the further development of information technology in education.

Following a telephone survey with the Hong Kong secondary students, a questionnaire survey with their teachers and a number of interviews with experts, scholars and students on “Information Technology in Education: Teaching and Learning”, we find that deficiencies in four areas - IT literacy; assessment and examination; research and development on software; provision of resources and assistance - impose potential barriers to the further development of information technology in education. Our analysis is as follows:

a. IT literacy: Aside from learning how to use information technology, it is more important for students to acquire self-learning abilities through information technology.

According to the experts/scholars interviewed, information technology has a role to play in facilitating teaching and its role should thus not be overstated as if it was a panacea to solve all problems in teaching. Experts point out that information technology is only one of several teaching techniques and should not dominate the way our students are being taught. Moreover, it is believed that in an information technology-based classroom environment, students should not only learn how to use information technology, but also and even more importantly, to acquire self-learning and organizational skills through information technology.

The pressure to use information technology means many teachers have spent much time and energy producing teaching materials in PowerPoint while some students think that the use of PowerPoint in teaching has distracted them from fully participating in class. This shows that Power Point presentation may sometimes discourage teacher-student interaction in class.

The question therefore is how to effectively utilize information technology. The use of information technology does not necessarily lead to good results if one pays no regard to the target recipients, the subject in question and the way information technology is to be applied. Indeed, information technology is only one channel through which knowledge and information can be spread since teachers can teach in various ways.

b. Assessment and examination: The current method of assessing and examining students is not keeping up with the development of information technology in education.

During our interviews with experts and scholars, a teacher said, “students think research projects are merely homework and they would rather put their effort in preparing for examinations. Impressive school records only come from high examination scores. Of course it is fun searching information for doing projects, but such tasks have no bearing on students’ academic prospects as their examination results determine everything.” The fact that students only care about their examination results could therefore impede the development of information technology in education.

Some interviewees noted that information technology in education is interactive in nature and this is incompatible with the current examination-based culture in our education system. Therefore, it is necessary to review and reform the current way of

examination and make it in tune with the trend of implementing information technology in education to effectively proceed with developing an information technology-based education.

The SAR Government has been reforming our education system in recent years with an aim to reversing the “one-way” learning approach in our curriculum. The government has attempted to turn our monotonous teaching culture into a more lively one focusing on interaction and self-learning. However, the current way of examination lags behind this pace of development of information technology in education. For example, information technology education emphasizes students’ abilities in searching, assessing, organizing and analyzing information and problem solving. In this sense, conventional examinations that judge students’ academic abilities by how well they memorize class materials are no longer appropriate. Unless there is an overhaul in the way students are assessed and examined, development of information technology in education in our schools may not proceed as expected.

c. Research and development on software: Investment on software manufacturing, the constraints of a small market and the protection of intellectual property are all important elements in the further development of software for information technology.

In the questionnaire survey, 39.8% teachers think that inadequate supply of teaching software is a major difficulty for implementing information technology in education. 11% have made appropriate teaching software themselves in order to overcome the above problem and 30.5% considered sharing their teaching materials using information technology on Internet platforms under intellectual property protection.

Among the experts and scholars interviewed, some express that working on information technology is not a teachers’ job. It may be a disservice if teachers are asked to produce teaching materials themselves as it deprives them of time better spent on teaching and places an extra burden on the teachers. The IT professionals interviewed in the study think it is their job to come up with suitable software. As regards developing new software for information technology in education, IT professionals are hesitant in assuming a more proactive role, especially considering the risk of a potential reversal of education policy just as the government has done in other policy areas. Moreover, a limited market size adds to the list of difficulties facing the development of software for information technology in education.

According to some interviewees, better protection of intellectual property rights and enhancement of information management are beneficial in the development of information technology in education. In our information age, instant transmission of images and ideas means easy mass duplication of materials. Better enforcement of intellectual property protection and implementation of an effective information management system are complicated problems that must be tackled, if we want to press ahead with the development of information technology in education.

d. Provision of resources and assistance: Providing adequate computers and assistance to schools, and bridging the "digital gap" are important for the sustainable development of information technology in education.

Our survey with secondary students shows that about 10% students have problems with information technology in education. 12.3% of them do not have computers at home, and 10.9% say there is a lack of computer facilities in schools. Our survey also finds that most of the students interviewed (96.4%) have computer with Internet access at home. While this figure is promising, the situation for the minority who are not that lucky should not be ignored. No student should be disadvantaged because of a lack of resources. When implementing information technology in education, our schools should therefore pay attention to the needs of those who lack access to computers so that all students are at a level playing field.

Moreover, interviews with experts and scholars as well as group discussions with secondary students show that the availability of information technology equipment has a direct bearing on the quality of learning and teaching. Nowadays, some schools still have no computer or Internet access in their standard classrooms. Even when teachers and students are happy to use information technology in class, they are easily discouraged by the extra time and administrative arrangements required by changing classrooms.

Some teachers think that a pre-requisite for interactive learning using information technology is to make the computers in classrooms more Internet accessible. Without Internet access, teachers cannot download information instantly and students lose the chance to actively search for their own, thus diluting the effect of interactive learning.

Among the secondary teachers surveyed, respectively 79.7% and 36.4% agree

that “lacking time in preparing teaching materials” and “lacking assistance” are major problems for implementing information technology education. In fact, teachers may already have had difficulties coping with pressure and adapting to changes because of a series of education reforms. The question of how to assist our teachers therefore deserves more attention.

The above discussions show that resource allocation is crucial to the effectiveness of information technology in education. The SAR Government has already invested a considerable amount of resources as outlined in the first of its “Five-year Strategic Plan”, which has laid a significant foundation in the development of information technology in education. On this basis, questions on how to ensure a sustainable development and allocate resources fairly are worthy of discussions.

5. Our study reveals that a clear division of roles played by teachers, IT professionals and the government is necessary in the development of information technology in education. Besides, a “resources-sharing” culture is beneficial to meeting the long-term goal of integrating information technology in the teaching and learning process.

Regarding the promotion of information technology in education, some experts are of the view that teachers, IT professionals and the government should all play a different role. Teachers can give comments as users; professionals can offer technical assistance while the government can act as the overall coordinator. Only with a clear division of roles can the project of enhancing the use of IT in education proceed effectively.

Some experts and scholars express the need of IT professionals and teachers working together in their different roles. In launching information technology in education, it is advisable for IT professionals to consult the teachers so both can work effectively. In this regard, it is observed that IT professionals sometimes work behind closed doors and are ignorant of the real life situations. To ensure effective use of resources, teachers are in the best position to give comments to IT professionals as direct users of their services. According to some interviewees, there is a role for the government to play as coordinator or mediator between the teachers and the professionals.

Cooperation between teachers, IT professionals and the government can reduce the burden on our teachers in producing the necessary teaching materials and allow

them to concentrate on teaching students. Feedback received from teachers can allow IT professionals to tailor services and support to teachers' needs and the government's function is to foster a viable working relationship between teachers and IT professionals.

As already pointed out, a "resources-sharing" culture is also necessary for the long-term goal of integrating information technology with teaching and learning, for example, by strengthening communication and links among schools and encouraging the sharing of relevant teaching materials through websites.

6. Setting a standard measure for information technology in education based on quality and quantity.

In 1998, the SAR Government released its first "Five-Year Strategic Plan", which set out the blueprint for promoting information technology in education. Five years later, the government put forward another consultation paper, "Information Technology in Education: Way Forward", as a summary of the achievements made over the preceding five years and a vision statement for future development. Looking back, Hong Kong has invested tremendous resources in acquiring hardware for information technology in education over the past five years. There are currently, on average, 91 sets of computers in our primary schools and 247 in our secondary schools. All of these computers have broadband Internet access[1].

This study shows the government is already capable of popularizing information technology in education and upgrading the IT skills among teachers and students, such as handling electronic mail, using search engines for finding information, presenting in PowerPoint and word processing. As for the benefits brought to our classrooms by the use of information technology, our interviewees are asked to give their rating given a score range from 0 to 10. Students who think information technology is beneficial to their learning give an average score of 6.86, while teachers who agree it helps their teaching give an average score of 5.98. This shows the use of information technology in education is generally welcomed by our teachers and students.

Nevertheless, the real picture of its effectiveness in long-term development can only be viewed against a standard measure which gives equal weight to quality and

[1] Education and Manpower Bureau, Hong Kong SAR Government: *"Information Technology in Education: Way Forward"* (March 2004).

quantity. To achieve this, it is necessary to focus on the goals of promoting information technology education and define a standard for gauging the quality and quantity of its implementation.

Recommendations

The SAR Government's effort over the past years in equipping our schools with adequate facilities and giving teachers appropriate training, that has laid a solid foundation for the future development of information technology in education, is commendable. As shown in our study, both teachers and students have become fairly literate in information technology and have a positive attitude towards the implementation of information technology in schools. Most of the student interviewees agree that the use of information technology has enhanced their interests and abilities in learning. Similarly, many teachers agree information technology has a positive impact on their teaching. Bearing the above in mind, we have the following recommendations for the policy makers in further expanding the use of information technology in education and improving the quality of teaching and learning in our schools.

(1) <u>Re-enforce teachers' role as "vanguards of knowledge"</u>- Our study shows that most of our teachers are fairly competent in using information technology and in assuming a guiding role for students in their search of knowledge in the world of information technology. However, information technology is only one of the means to be used in teaching. It therefore follows that the role of teachers as "vanguards of knowledge" can be re-enforced so that they can help students to improve their self-learning skills by encouraging them to search for knowledge, to organize information, to analyze information and to establish viewpoints.

(2) <u>Formulate appropriate assessment and examination mechanism</u> – Information technology in education aims at increasing students' abilities in searching, organizing, analyzing information as well as their problem-solving skills, so that our students will be exposed to more knowledge. If the Government keeps our existing memory-oriented examinations unchanged, this may fail to make an accurate assessment of our students' performance in the new education environment. Therefore, as

information technology in education has become more popular, we recommend the Hong Kong Examinations and Assessment Authority to review our existing examination mechanism, thereby taking into account the features of information technology in education and the changes it brings to our schools, in particular the increased emphasis on students' organization skills, analysis skills and problem-solving abilities.

(3) <u>Encourage sharing platforms among teachers</u> – Teachers now have the extra burden of preparing IT teaching materials despite an already heavy workload. Our figures show teachers lack sufficient time in making teaching materials and are under pressure. They also think that the software currently used does not meet their actual needs. In fact, the responsibility for making IT teaching materials should not fall on individual teachers since one of the characteristics of information technology in education is fostering a resources-sharing culture. Therefore, we suggest the authority to encourage our teachers to set up platforms for sharing IT teaching materials, and at the same time, safeguard intellectual property rights, so that teachers are more willing to share their materials through this channel.

(4) <u>Facilitate coordination between IT professionals and teachers</u> – As expressed by some IT experts, teachers need not spend extra time making IT teaching materials. Instead, they should work with IT professionals so that the latter can produce software meeting teaching requirements. We therefore recommend the government to encourage coordination between IT professionals and teachers, so the IT professionals can concentrate on creating suitable software and teachers have more time for teaching.

(5) <u>Formulate new assessment criteria to evaluate the success of IT in education</u> – Information technology in education is an interactive process that goes beyond the constraints of classroom space and school hours. Effectiveness assessment criteria based on the number of hours teachers spent on teaching are therefore no longer appropriate. So, we suggest

new assessment criteria focusing on whether our students are motivated to learn through the introduction of information technology in education.

(6) <u>Understand the trend of information technology and make long-term strategies</u> – Now that most of our schools have facilities for connecting to the Internet and some are equipped with wireless Internet access, there is space for further advancement of information technology in education. Video-conferencing technology has eliminated the boundaries between schools which makes simultaneous lessons possible. The development of electronic book technology, allows students to have their personal mini-libraries in the future. In light of all these, we recommend the authority take into account the rapid growth and development of information technology when planning for the next phase of policies on information technology in education, so that it follows the dynamics of information technology closely.

(7) <u>Render more assistance to schools in developing information technology in education</u> – To sustain the development of information technology in education, our schools need adequate resources in renewing and repairing existing facilities, as well as advice from exports. The authority should provide the necessary facilities to schools that do not have Internet connected computers. Besides, it should take the initiative in updating and repairing the existing facilities regularly and allow schools to adopt flexible policies in procuring professional services directly or hiring in-house IT consultants.

(8) <u>Bridge the digital gap by working with the IT profession</u> – Our figures indicate a "digital gap" as a small number of students still have no computer at home. We suggest the government to call on the IT profession to take initiatives, such as renewing old computers and providing free or concessionary Internet services for the students in need, with schools or youth organizations acting as agents. It will give all students an equal opportunity to take the advantage of information technology in education.