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Perceived Benefits of eduPAD in Enhancing Learning

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Abstract

The paper presents the findings on an evaluation of a proto-type hand-held electronic device that allows learners to access the Internet, communicate with each other and read textbooks stored on storage cards. The pilot project was carried out in a secondary school in Singapore. At the end of the trial period through a survey and focus group interviews the benefits of this innovative device as perceived by the teachers and students were determined. Both the teachers and students expressed a positive attitude towards the use of an electronic device to enhance teaching and learning. However, they also pointed out that the barrier to the use of eduPAD device in the classrooms resulted mainly from technical problems, such as slow speed of loading and accessing time to the Internet. The students also said that the instructional approaches used in eduPAD classrooms were largely the same as those found in traditional classroom

The findings suggest that introduction of electronic devices per se into the classroom would not bring improvement in teaching and learning automatically. Teachers and students need to modify their teaching/learning strategies and make full use of the opportunities provided by such a device to do things otherwise not possible.

Introduction

There is an abundant body of literature suggesting that technology tools can support learning as they can create a learning environment that provides meaningful and challenging exploration as well as independence in learning. For example, a teacher can provide a computer based learning environment, where the students take the active-independent initiating role, while the teacher takes a coach-support facilitating role (Duffy & Jonassen, 1992; Perkins, 1991). Research studies also indicate that when students interact with the computers they become inquisitive and creative with an increase in their level of intrinsic motivation as a result of acquisition of the freedom to take over their own learning (Armour-Thomas, 1992; Ganguli, 1992; Gatto, 1993; Lehman, 1994; Moar & Fraser, 1994; Wang & Sleemen, 1994).

The problem faced by teachers in providing computer-based learning is the lack of access to computer facilities in the schools. Currently schools in Singapore have the provision of computer labs/rooms equipped with twenty or so computers in each room and a few computers in the classrooms. Students are required to share the computers. This station based set up is an inadequate provision for effective computer-based learning environment. Moreover, students have access to these computers only when the teachers take them to these rooms.

Anticipating the future needs of the society and the need to prepare the people for a knowledge driven economy the Prime Minister of Singapore Mr. Goh Chok Tong in his 1996 Teacher's Day Speech said:

" We will use IT to encourage students to learn more independently, to learn actively. [...] They must learn to locate information in databases around the world, sieve through them, analyse what they get, and apply it to their projects in innovative ways. These will be key skills for every worker in future".

In response to this view of the Prime Minister, the Ministry of Education, Singapore (1997) came up with the most significant development related to the use of IT in education through the issuance of the Masterplan for IT in Education. This plan is now the major engine of change in schools promoting the use of IT for education. The Masterplan envisages that by 2002 pupils will spend up to 30 percent of curriculum time using IT. To achieve this, a pupil-computer ratio of 2:1 is targeted for every school by 2002. The plan is being implemented progressive in all schools.

While this plan is in progress, in 1999 the Ministry of Education, Education Technology Division initiated an R&D project to develop a proto-type hand-held wireless computer (eduPAD), which is inexpensive so that all students can have one each and use it on an anywhere-anytime basis. This hand-on classroom tool with the ability to access the networks was envisaged as a motivator for students to actively engage in learning and that its use could encourage the kind of independence and autonomy that many educators agree is important for students to achieve in their learning. Wireless networks are no longer strictly experimental. Educational institutions are going into the wireless technology in big ways with the expectation that the networks will enhance teaching, learning and research. Wireless networks are also well suited to collaborative learning. For example, students anywhere on campus can form small learning groups online to tackle any learning task/problem (Olsen, 2000).

The eduPAD Project

The development and testing of the proto-type electronic device (eduPAD) in a trial school was an inter-agency collaborative project involving a number of institutions in Singapore. The Ministry's industrial partners were mainly responsible for the development of the hardware device and the software applications for the device. The Educational Technology Division of the Ministry of Education was in-charge of the training and exploration of the use of the eduPAD system in the trial school. The National Institute of Education was invited to evaluate the pedagogical use of the eduPAD in the classrooms.

The eduPAD device



The eduPAD is a hand-held electronic device designed to enhance teaching and learning in schools. It weighs about 800 grams. It has an 18-cm (diagonal) VGA LCD colour display panel combined with a built-in microphone and speaker, to enhance pupils learning experience by allowing for a more engaging and interactive interface. It works on a rechargeable battery, which lasts up to six hours. The method of input incorporates both the Stylus and Virtual Keyboard. In addition to the eduPAD's resident memory of 16MB, the device provides interfacing slots to data storage cards. These are memory cards the size of postage stamps, with a storage capacity of 16MB. The school subject textbooks have been converted to eduBOOK. eduBOOK brings textbooks to the students via a digitized format. Incorporation of hypermedia features helped accelerate students' searching for information and enhance their understanding of concepts by animations and audio effects. By inserting the eduBOOK chip into one of the interfacing slots in the eduPAD pupils could access information from the eduBOOK.

How the eduPAD system works

Figure 1 illustrates the set up of the system in the school. Teachers can use the system to create and carry out class activities. For example, teachers can prepare assignments (e.g. worksheets & quizzes) using a PC in the staff room that has been installed with the Teacher's Management Tool (TMT) software.

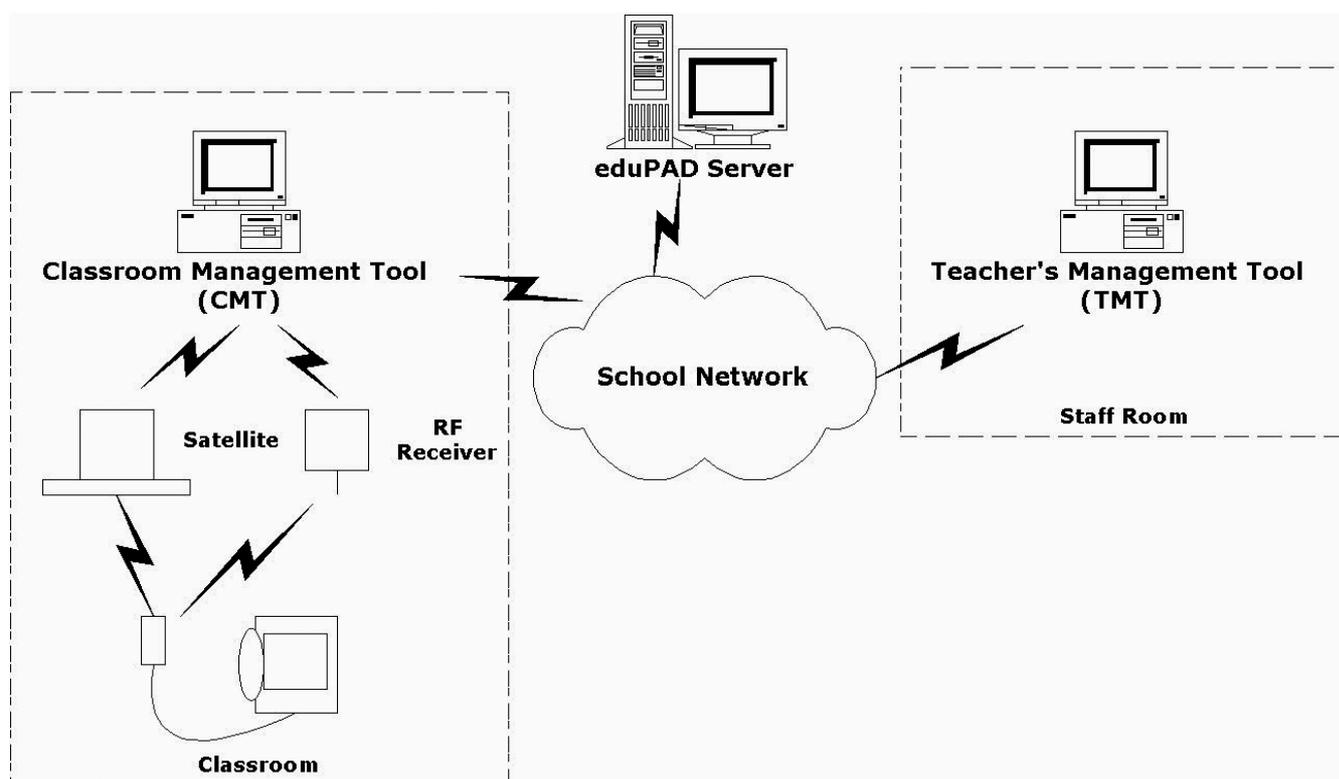


Figure 1: The eduPAD System in the school. [Source: KRDL, MOE (ETD)]

These files can be saved onto the eduPAD server via the school's existing local area network (LAN) system. They can then be sent through the Classroom Management Tool (CMT) to the pupil's eduPAD during the teacher's lesson or they can be saved as files that

pupils could download through the Homework Tray of the pupil's eduPAD. In the latter case, the pupils would be alerted of the files in the Homework Tray for downloading through email.

When the teacher walks into the classroom, he downloads his files onto the classroom PC that has been installed with the Classroom Management Tool (CMT) software. With a click of a mouse button the assignment files are beamed to the pupils' eduPADs via diffused infrared satellites mounted on the ceiling of the classroom. Alternatively, the pupils would have downloaded their assignment from the server through the Homework Tray before the lesson and the teacher simply gets the pupils to do the assignment.

Pupils can submit their completed assignments wirelessly using radio frequency waves. A radio frequency receiver mounted on the ceiling picks up the data from the eduPADs and channels them to the CMT for auto marking and collation of results. A copy of the data is also automatically sent to the eduPAD server. The teacher is thus able to get instant feedback on the performance of the pupils. Pupils on the other hand can use the device as a platform for their work, on which they can carry out hands-on and collaborative activities. Pupils can submit their completed assignments/work wirelessly using radio frequency waves. In addition, pupils can use the eduPAD to plan and organise their timetable, set up a task list to prioritise their work, take notes, email their peers and access the Internet and the eduBOOKs to source for information.

As an IT communication tool, eduPAD offers tremendous pedagogic potential for learning both in the classroom and at home. Access to Internet expands classroom resources for learning dramatically by making many resources from all over the world available to students. It brings information, data and images into the classroom from place otherwise impossible to access and it does this instantly. However, the exact nature of what constitutes the best pedagogic practice for optimizing the use of eduPAD in the classroom is the key research question that this whole project hopes to answer. Basically for this initiative to be successful there has to be some change in the teaching-learning milieu in the schools. The fundamental shift that will be required is a shift from the teacher-centred examination oriented education to learner-centred holistic education. This initiative calls for skilled and sensitive teaching that is carefully planned. It demands that teachers change the ways that they relate to their students and students change the way they regard their own learning in radical ways.

The development and testing of this electronic device is an effort on the part of the Ministry of Education to help teachers make a shift towards creating a learning environment that is more student-centred. It was also hoped that it would help shift teacher's mindset about learning from a receptive to a constructive paradigm and thus make them feel comfortable in a coach-support-facilitator role. While the students on their part would become more responsible toward their own learning and not depend solely on their teachers to feed them with information.

Lessons involving the use of eduPAD were video taped for analysis. The analyses of these lessons are reported elsewhere (see Lourdasamy, Wong & Hu, 2000). This paper reports the benefits of eduPAD to enhance learning as perceived by teachers and pupils.

Teachers and students perception of eduPAD

The eduPAD project was implemented in secondary 1 classes in a Singapore secondary school from January to October 2000. At the end of the trial period through survey and focus

group interviews the benefits of this innovative device as perceived by teachers and students who were involved in the experiment were elicited. The findings are reported here.

Teachers Perception of the eduPAD system

All the ten teachers who were involved in the trial of the eduPAD attended the focus group interview. In general the teachers were positive about the use of an electronic device to enhance pupil learning by making them more responsible for their own learning. But they pointed out that the technical difficulties encountered with the device need to be resolved before any such device is introduced into the classroom. In their experience with the device they reported that a lot of class time was wasted in attending to technical problems. This resulted in frustration both for the pupils and the teacher.

Some teachers reported that pupils when they were able to get access to the Internet were able to come out with useful information pertinent to the topic of the lesson. But Internet access was very limited to students as access was possible only in the classroom and the library. During the lesson the pupils generally had difficulty in accessing the Internet due to technical problem when 40 odd pupils try to access it at the same time. Some pupils as a result of the initiated Internet activity in the classroom went home and used their home computer to continue their search. On the whole teachers reported that the ability to browse the Internet was a useful feature as it enabled the pupils to go beyond the textbook to the global resources and read real authentic reports. This they said could enhance the spirit of self-learning and life-long learning.

Most teachers expressed the view that if the CMT system worked properly that it would be a very useful feature for the teacher. They could prepare quizzes, worksheets and assignments for use in the classroom. The mathematics teacher reported that she was able to monitor her pupils' progress in her subject by conducting pre- and post-tests for her lessons. Using the analysis of result feature she was able to identify the weaknesses, misconceptions and individual difference in level and rate of mastery of content of her pupils.

Some teachers found the resources in the eduBOOK useful in planning their lessons, especially the enhancement features of the eduBOOK like animation, sound effect and hyperlinks. These features helped them to illustrate some of the abstract concepts more meaningfully.

In summary it can be said that the teachers valued the Internet access feature, the enhancement features of the eduBOOK and the opportunity to prepare and sent out quiz and get immediate feed back

Students Perception of eduPAD

What did the students think about this innovative device? Did they benefit from using eduPAD? To answer these questions, we administered a questionnaire to the students and conducted group interviews at the end of the trial period. A total of 116 pupils responded to the questionnaire. In addition, two focus group discussions were held. Twenty students selected by their respective form teachers joined the discussion sessions, ten students per group.

Overall Perception

The students were generally optimistic about the potential benefits that could be brought about by eduPAD. When asked whether they would like to continue to use wireless handheld devices similar to eduPAD, 72% said they would. Of the 116 pupils who

responded the questionnaire, 53% agreed or strongly agreed that "classroom lessons were more interesting when eduPAD was used", and 40% agreed or strongly agreed that they were "eager to learn when eduPAD was used in class". When asked what has made eduPAD lessons more interesting, pupils often mentioned the incorporation of multimedia features of the eduBOOK, getting immediate feedback from the teacher and the use of Internet to search for more information during the interview. Examples of positive responses included:

- " Sometimes pictures cannot explain the process. Videos help us to understand the process."
- "animations allowed us to see the whole process of an evolution "
- "we could receive immediate feedback from teachers"
- "Internet enabled us to look for more information"

For the 46.5% students on the other hand disagreed or strongly disagreed that "classroom lessons were more interesting when eduPAD was used". It appeared that their negative feelings resulted mostly from the problems encountered when accessing the information. Examples of negative sentiment expressed were:

- "the system always hangs and this interrupted learning."
- "it took a long time to load and turn pages" (eduBOOK chips)
- "too many chips"

The eduBOOK

Seventy-two percent of the pupils agreed or strongly agreed that multimedia features made information displayed in eduBOOK more interesting. Although the technology was not yet developed to accommodate all the envisaged activities, the students saw the value of embedding multimedia features in instructional materials. Fifty-five percent of the pupils surveyed agreed or strongly agreed that enhancement in eduBOOK helped them to understand the concepts introduced better. Positive comments on eduBOOK during the interview included

- "the animations in the eduBOOK were useful"
- "hyperlinks helped us to search information"
- "they have animations that normal textbooks do not have."
- "it provided mini tests for us to do and we can send it back to the teachers."
- "we could get immediate feedback of what we have done."

It was evident that incorporation of multimedia features into the eduBOOK aroused the students' interests in learning. Its unique features not available in normal printed textbooks had fascinated the students. However, 62.9% of the students were negative when asked whether they found it easier to learn concepts in eduBOOK than in normal textbooks. The negative feelings seem to have resulted mostly from the problems encountered when accessing the information. Some students expressed their problems as follows:

- "the animations in the eduBOOK were useful but processing time was often slow."

- "there are too many chips and we have to change chips so often. Loading time is slow".

These feedback from the students suggest that unless technical problems are solved, i.e. speed of loading etc., it is difficult to make eduBOOK comparable, let alone superior, to printed textbooks.

Use of Internet

An overwhelmingly big percentage of students (74%) thought that accessing Internet during lesson helped them to learn (Chart 4). When asked for examples of Internet use during lessons, four instances were unanimously mentioned by both groups, (1) periodic table for Science, (2) rice cultivation and (3) formation of waterfalls for Geography and (4) ruins of cities for History. The students believed that WWW provided additional information not available in the textbook and such information helped them to understand the concepts covered. Another advantage of using Internet mentioned by the students was that Internet helped them to do research. It appeared that some students revisited the same sites again outside the classroom. Positive comments on Internet use during eduPAD lessons included:

- "we can do on-spot learning"
- "know the topics and we can research on it"
- "it provided additional information and hyperlinks"
- "teachers showed us websites and we looked at them after class."

The positive attitude towards the Internet use in the class may be mere perceptions resulting from a "common" belief that Internet is good and therefore it will help learning. Some students said that they would "rather listen to the teacher", as "only few could log on, so it did not really help." Review of taped lessons also confirmed that many students had difficulty in getting Internet connection during the lesson time.

Teacher-Student Interaction

One of the objectives of eduPAD is to increase teacher-pupil interaction. It was envisaged that with eduPAD "teacher can communicate with pupils and check their understanding of the lesson quickly via infra red communication. Attention can be given to areas that pupils find difficult in understanding " (ETD document, 18 August 2000).

Forty-seven percent of the pupils agreed or strongly agreed that with eduPAD they received immediate feedback from the teachers, 37.9% disagreed or strongly disagreed, and 14.7% indicated that the feature was never used in their classes. The feedback was largely, according to the students, answers to quiz questions. Some students commented that though they liked immediate feedback as knowing the correct answers helped them to learn their mistakes right away but they could learn better why they were wrong if the teacher could offer explanations.

The findings seem to suggest that eduPAD did not improve communication between teachers and students. Close to 58% of the students disagreed or strongly disagreed that with eduPAD they communicated with teachers more than before, and 27.6% indicated that they never communicated with teachers via eduPAD. The assumption has been proven wrong that eduPAD would enable shy students to use the device to ask teachers questions. As one student commented "I did not bother to use eduPAD to ask teacher questions. I would just raise my hand and ask."

Peer Learning

Development in wireless technology makes it easier than ever for learners to use the technology as a collaborative learning tool. Such collaborative learning tools provide increasing opportunities for learners to share experiences across time and space. One of the envisaged benefits of eduPAD is that "it will facilitate collaboration among pupils, as they can interact with one another using the eduPAD via infrared wireless communication" (ETD document, 18 August 2000).

It was encouraging to find that 56.9% of the students agreed or strongly agreed that eduPAD enabled them to discover knowledge with friends, while 40.5% disagreed or strongly disagreed (Chart 6). The students of 1C, in particular, described their experience of using eduPAD in interdisciplinary project work (IPW). Apparently, the students used cooperative learning strategy to accomplish their IPW project. They divided the tasks among themselves, and each of them used eduPAD in searching and organizing information in the library. They, then, sent their work to one another before compiling them into one single group product.

eduPAD provided students with a tool to communicate with one another and share knowledge. Forty-one percent of the respondents agreed that eduPAD enabled them to interact with classmates easier than before, while 54.3% disagreed or strongly disagreed. The students commented that

- "I used eduPAD to send work to my classmate"
- "I could send email to my classmates"

When asked whether eduPAD made cooperation among students easier than before, 65.5% of the students chose disagree or strongly disagree. It was interesting to find that the students did not complain about the technology as they would for other tasks when asked for reasons that prevented collaborative learning to take place. They attributed the barriers that prevented them from using eduPAD as a collaborative tool to the fact that the topics being learnt did not always allow them to learn together. According to the students, teachers taught largely the same when eduPAD was used in class and activities did not require collaborative effort. All this suggests that further research need to be conducted to find out how lessons may be planed in such a way that students are encouraged to use this technology for collaboration among students and interaction with teachers.

Moving towards independent learning

It was envisaged that "with its portability, eduPAD can support learning anywhere and anytime" (ETD document, 18 August 2000). Being at its trial period, eduPAD has failed to make this to happen (Chart 7). The findings of the survey suggest that

- only 27.5% of the students believed that using eduPAD enabled them to make more decisions about their own learning, while 65.6% disagreed or strongly disagreed
- 34.5% of the students believed that eduPAD enabled them to be more organized, while 61.2% disagreed or strongly disagreed
- 32.7% of the students thought that with eduPAD they were more motivated to learn even without guidance, while 64.6% disagreed or strongly disagreed.
- 31% of the students thought that eduPAD enabled them to monitor their assignments, while 59.5% disagreed or strongly disagreed.

The students attributed the factors that prevented them from independent learning in school to:

- "the instructions were all given by the teacher"

- "teachers did not give topics which allowed for independent learning"

Some students commented that the single period allocated for the use of EduPad was too short for independent learning to take place.

Only 8.6% of the students used eduPAD outside the class more than once a week, while 14.7% used it once a week or less. The students attributed the factors preventing them from using eduPAD outside the class to:

- "cannot use Internet at home"
- "loading is rather slow. I'd rather use my normal textbook"
- "if mistakes were made in Scribble, have to erase it and start all over again"
- "charged eduPAD cannot last long"

- "troublesome"

Conclusion

Both the teachers and the students have a positive view towards the use of electronic communication device to enhance teaching and learning. However, they were apprehensive that the technical problems associated with the use of electronic devices could disrupt the smooth flow of the lesson. Both the teachers and the students have experienced a number of technical problems with the prototype device used in the current experiment.

The teachers were of the view that the TMT was a useful system for teachers to prepare quizzes and worksheets before the class and CMT to monitor students' progress. They also found the enhancements in the eduBOOK helpful in teaching concepts. In fact some of the teachers suggested that the eduBOOK should consist of enhancement resources for the teaching of their subjects instead of converting the whole textbook into a static eduBOOK.

The students too were on the whole optimistic about the potential benefits that could be brought about by the use of eduPAD. They expressed similar positive sentiments about the use of eduPAD. More than 50% of the students were of the opinion that the classroom lessons were interesting with the use of the eduPAD. In particular they found the access to Internet and the enhancements in the eduBOOK as useful features to help them get a better understanding of the subject content. Negative views expressed towards the use of the eduPAD were mainly related to the technical limitation of the proto-type device. Nearly 75% of the students expressed a desire to use such a device as a learning enhancement tool.

The other objectives of the device to increase student-teacher interaction, collaborative peer learning and independent learning were not achieved to the extent as expected. The short trial period and limited usage by the students may have made it difficult for eduPAD to produce real impact on students' learning.

On the whole it can be said that the eduPAD device has the general features and potential to engage pupils in independent and collaborative work but has to be made more versatile, reliable and interactive if it is to function as a teaching-learning tool in the classroom setting. Also, it has to be kept in mind that bringing a tool like eduPAD into the classroom alone will not result in changes automatically. Teachers need to modify their teaching strategies to

accommodate the unique features offered by the new technology and provide learners with opportunities to access knowledge experts as well as their peers. Such a learning teaching-environment could lead to the achievement of the major objective of the shift in education, that is, to empower the learners to become more independent in the learning process so that they would develop the attitude and skills for lifelong learning.

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