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A Case Study of the Development of
An IT Learning Environment In A Secondary School in Singapore

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Abstract

The study, using the naturalistic inquiry approach, sought to explore the initial efforts to bring about an innovative IT learning environment in a Singapore secondary school. It also examined the change process, teacher readiness and the implications of national policies in IT use.

The inquiry revolved around three clusters of stakeholders: (a) the early adopters comprising three teachers, three pupils and the researcher; (b) the recipients or teachers in general; and (c) the School's decision-makers. Data collection involved structured and unstructured interviews with members of the School as well as a decision-maker of the national IT policy, observations, a School-wide survey of all teachers of the School as well as examination of relevant documents. The various data collection methods and triangulation ensured trustworthiness of the inquiry. The main study was conducted between July 1995 and December 1996 with additional data collection conducted in the first half of 1997 to take cognisance of significant developments in the national educational scene.

The inquiry revealed, amongst other things, that teacher readiness must be emphatically addressed before IT can be used successfully in the classroom. Teachers' failure to adopt IT in the classroom was also not so much resistance to IT per se but that their fears and anxieties had not been considered. Staff development, taking into cognisance the different needs and entry points, is therefore very crucial. For the potential of IT use in the classroom to be realised, the learning environment must also encourage collaboration, knowledge construction and reflection (Jonassen, 1995). IT must be used more as a thinking tool than a delivery tool. This demand is onerous on teachers if they are not ready, and if the national curriculum and assessment systems do not support such a learning environment.

Introduction

This study explored the initial efforts to bring about an IT innovation in an independent School in Singapore. It was conducted between July 1995 and December 1996 with more data-collection taking place in the first half of 1997 to take cognisance of significant developments in the national educational scene. For the purpose of this paper, only the rationale for the research as well as some findings and recommendations are discussed.

Rationale of the Study

Independent schools in Singapore, by virtue of their existence, are to set the pace for other non-independent schools in the country. The school that was chosen for the setting of the inquiry is a leading independent boy secondary school. Given the calibre of the pupils of the school appreciated its responsibility of grooming quality leaders for the country. Besides skilled and competent technical workers, the country also needs visionary and innovative mangers and leaders especially in the 21st century. The school hence constantly sought to incorporate elements that went beyond the academic programme. Keer's (1968, p.16) definition of the curriculum as "... all the learning which is planned and guided by the school, whether it is carried on in groups or individually, inside or outside of the school" therefore seems to find expression in the school life when one reviews its total curriculum. The addition of a boarding element in the school since 1995 also added another dimension to the pupils' exposure to different learning experiences.

With that backdrop in mind, the researcher was initially keen to find out how the use of IT could further enhance the learning experiences and outcomes of the pupils. The researcher was then the Director/Pupil Development of the School.

From this point, the first person pronoun shall be used.

As an early adopter of IT use in the School, I was fascinated by its potential. My interaction with other early adopters, among the teachers and pupils within the School, also sharpened my interest. Research too seemed to indicate that IT use could develop the pupils' thinking and critical faculties and that it contributed to their communications skills and confidence level (Riel, 1992; Weir, 1992; Hancock & Betts, 1996; Dwyer, 1994; Chen et al., 1996; Chen, 1997).

The inquiry began in mid-1995, at the time when the groundwork for the development of the School IT Plan had just begun. This was before the Ministry of Education (MOE) announced its S$2 billion Masterplan. Around then, the Internet was still in its nascent stage and in Singapore, only those involved in scientific research and academic exchanges seemed to be cognisant of its existence. The only other school in Singapore that seemed to be aware of its immense potential and was also taking deliberate steps to harness it was Raffles Girls Secondary School (RGSS). Perhaps there were attempts by other schools to develop their own IT plans, or at least attempts by pockets of teachers to experiment with its potential, but if there were, they were isolated cases.

My focus began with how three teacher-early adopters perceived IT could be used for their pedagogy, the motivations behind their use of IT and whether IT use would change the way they eventually teach and the way the pupils eventually learn. I believed an in-depth understanding of this research problem would be useful to the School even as it was looking into introducing the use of IT among its members. As I had wanted to research the teachers' backgrounds and motivations, adopting the naturalistic, qualitative paradigm (Lincoln & Guba, 1985) using a case study design became a natural choice in the inquiry.

The Refined Rationale
As I collected and analysed the data and concurrently engaged in more literature review, the initial research problem with the focus on the three teacher-early adopters expanded into a case study of different stakeholders of the School. Besides looking into the three teacher-early adopters, insights into the circumstances under which the initial efforts to develop an innovative IT learning environment had taken place and an understanding of the stakeholders' varied responses to IT use appeared to be a more useful inquiry. As the study progressed, my readings and reflections revealed that the potential of IT could only be fully capitalised when the conditions and circumstances were favourable. A conceptual framework comprising these conditions hence emerged. They are the educational change process dimension, the teacher readiness dimension and the national policies dimension (Fig 1). My research questions were:

1) *Was the concept of IT clear to the teachers and to what extent was it adequately adopted?*
2) *What were the reasons for the early adopters to use IT in the School and what were the factors that contributed to late or non-adoption?*
3) *Were the teachers prepared and ready to use IT to enhance learning?*
4) *Was the adoption of the School IT Plan in line with national policies and the national IT Masterplan?*
5) *What are some of the possible implications for the development of the School and its pupils as leaders in society as a result of the School's IT Plan?*
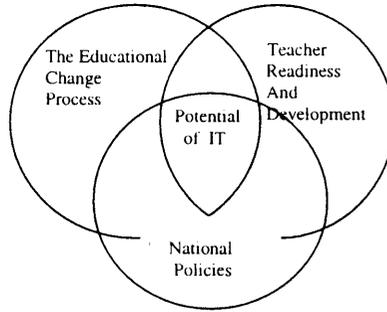
Figure 1: The three dimensions under review

The Purposive Sample

The focus of the inquiry was on the School's stakeholders, stakeholders being those with vested interest in the School, and in particular, that of the teachers. They were 1) the early adopters; 2) the recipients; and 3) the decision-makers.

The Early Adopters. The early adopters, also known as teacher-early adopters, were three teachers under the Gifted Education Programme (GEP) hosted by the School. They had impressed me with their interest and excitement over the use of IT and it was also with this group of teachers that I had most professional discussions even before I embarked on the study. For this reason, I had chosen them for the sample, as they appeared to fall under Roger's (1983) definition of early adopters. Data were collected mainly through observations, and structured and unstructured interviews. I had also included myself as part of this cluster as a teacher-administrator-early adopter.

The Recipients. The recipients were teachers of the School. They were members of the School who were recipients of whatever IT Plan the School eventually implemented. For this group of respondents, data were gleaned mainly from feedback from the School-wide survey conducted in January 1996, observations made when I was both a participant-observer and then a non-participant-observer, unstructured interviews with some teachers of the English Language Department and E-mail correspondences.

The Decision-Makers. The decision-makers comprised the Headmaster of the School and the Board of Governors (BOG). Rationale for the BOG's decisions and thinking with respect to the IT plan were obtained from the Headmaster and also the Head of the newly formed IT Department (HoD/IT Dept). Data-collection took the form of observations, structured and unstructured interviews, school documents and E-mail correspondences.

Throughout the study, I was the human instrument. While I began first as a participant-observer, I later became a complete observer when I left the School in January 1996. As a complete observer, I was able to conduct myself more objectively as my personal inclinations need not intervene with what I thought could be best for the School and the teachers.

The Findings

1. Introduction of any educational change and especially that of IT use in the classroom involves variables that can be categorised under curricular, non-curricular, teacher-readiness and institutional concerns (Appendix). Concerns and issues expressed by stakeholders of the School must be addressed and reflected over by the leadership as these may become possible forces of conflict. The planning process must be holistic and systemic, integrating these variables, and overarched by a vision shared by all stakeholders.

2. The School is an open system that needs the support of members in its bigger social system. For the diffusion of IT innovation, support from the industry and even former pupils, for example, is essential. Government policies provide the standard and the guidelines, it being an independent notwithstanding. With the recent enunciation of the national IT Masterplan and the decision by the MOE to modify its ranking methodology, the School can look forward to implementing a more effective IT plan. On the micro-level, the IT committee also cannot work independently of the other sub-systems of the School.

3. An IT plan inevitably involves many projects like co-ordination of current resources, setting up an IT department, relooking at the curriculum and staff development. A vision must overarch and unite these projects. Hence, the leadership must have a focused vision without which teachers may be confused by seemingly conflicting signals as to what the School's priorities are.

4. In the School context, perhaps a critical mass of Internet users has already been attained. Hence teachers' failure to adopt IT in the classroom may not be so much due to the resistance to IT use per se but to the fears, anxieties and insecurities that have not been addressed.

5. Different teachers have different learning styles and they will have different entry points as far as understanding IT use in the classroom is concerned. Their personal characteristics may also lend them to Roger's (1971) different "adopter types". An appreciation of the types and who the opinion leaders are might inform the staff development programme.

6. Teachers can improve their IT know-how when they do not feel threatened by their pupils' extensive knowledge or do not mind learning with and from them or from any one else who can coach them. Undergirding this approach of learning is Vygotsky's (1978) understanding of proximal development and social mediation which seems to be the spirit of the IT age (O'Neil, 1995).

7. Pupils of the School are exceedingly more capable than what the "O" level examinations appear to expect of them. While the school philosophy is to develop well-rounded pupils, the current academic focus of the School is perceived as one that encourages pupils to score distinctions for the "O" levels. In practice, therefore, other cognitive accomplishments may be inadvertently sacrificed.

8. The ranking of schools in Singapore and the conventional assessment system seem to counter the current efforts and encouragement by the Ministry of Education to develop a more collaborative and constructivist kind of learning environment. A dramatic shift in teaching practice will have to take place if the potential of IT is to be fully harnessed. However, teachers keen to experiment must feel that the leadership is supportive of their experimentation which may result in unpredictable outcomes like a drop in grades. Meanwhile, the School seems to be waiting for the MOE to make the first move before it embarks on any major curricular or pedagogical transformation.

9. The characteristics and qualities of the pupils enrich the School environment just as the latter further stimulates the pupils. This dynamic relationship seems to be at its best when the School environment fires the pupils' imagination and gives them the opportunity and freedom to explore, experiment and assume different kinds of responsibilities. In the process, the pupils challenge one another and their teachers to increasingly better themselves and that further energises the School environment. The School hence has the responsibility to ensure that it continues to sustain and excite its dynamic culture and ethos - features which have been the backbone of the School's historic strength.

Recommendations

While the following recommendations are made with the School, other schools or NIE in mind, what will sustain the "levelling up" of the educational community remains dependent on the MOE's overall vision and policies. The recommendations are hence not disparate suggestions but part of the whole understanding of how IT can improve the quality of education in Singapore.

School-Level
1. An overarching vision
The leadership, in particular, the Headmaster may want to be seen articulating a focused vision of IT use in the School curriculum. It is not just the responsibility of the some members of the IT department to disseminate the use of IT but the Headmaster, his deputy and all the department heads of the School. Before that can take place, the School may have to relook what it has done so far (the IT plan having been in place for almost a year at the point of writing) and make adjustments to its 3-year plan, if necessary. The decision to adopt an IT plan is not a one-time decision. A series of constant adjustments and readjustments throughout the diffusion process may be essential. Teachers too need considerable reflective experience before they can form a plausible vision and this must evolve through constant interaction.

2. Staff Development
2.1 Teachers have strong beliefs about the content of their subject curricular and about the ways in which their curriculum should be taught. They should hence be given the opportunity to examine examples of the ways in which their subject's content knowledge could be delivered and their subject taught through and with IT. They also need time and support to begin to find ways in which the examples of IT they have examined could be used in their teaching.

2.2 The School may want to embark on a whole-school approach of staff development taking into consideration the different learning styles, entry points and adopter types of the teachers. The traditional one-day workshop will be inadequate. A realistic time-frame of at least 3 years too must be given to the teachers to be trained. So while there may be urgency to be trained as quickly as possible, teachers must not feel threatened or incompetent if they need more time than others to acquire the skills. A spirit of collaboration and desire to learn could be developed in the School culture so every bit of progress by teachers, no matter how slow, is recognised and encouraged.

2.3 The School may also want to be part of ETD's staff development programme. The ETD's approach seems promising as it is done on both a school-wide and departmental basis. As the ETD Senior IT Instructors will have had at least a year of experience with other demonstration schools, the School may be able to reap the Senior IT Instructors' experiences and hindsight should it seek to be involved in the ETD's programme.

2.4 Collaboration between the School and higher education could be actively sought. Researchers from the various tertiary institutions may want to conduct studies and test their designs in the School, for example, and the School could see this as opportunities for further learning.

3. Curriculum and assessment

While the MOE is currently relooking at how the content of the curriculum can be reduced and the assessment mode can be modified, the School may want to take steps to be more adventurous in its curriculum. Besides paying attention to staff development, conventional approaches to instruction could be modified or replaced by those that will engage learners in:

- knowledge construction, not reproduction;
- conversation, not reception;
- articulation, not repetition;
- collaboration, not competition;
- reflection, not prescription.

(Jonassen, 1995).

This will be in line with the national policy of wanting pupils to be better thinkers. Until the School reforms its conceptions of learning, IT will be used more as delivery vehicles than tools to think with.

National Level

Other schools in Singapore which have not yet drawn up their IT plans may wish to consider the following points:

1. Important to realise that not *all* teaching staff in any particular school will be interested in innovations aimed at developing the use of IT for teaching. Teacher resistance among the laggards (Rogers, 1971) may mean rejection of the innovation if these teachers are forced to participate in the programmes. For such teachers, the influence of a critical mass of users or opinion leaders may be more effective.
2. Principals will need to appreciate the teachers' fears and concerns as well as the stress that comes with change. Change strikes at the core of learned skills and beliefs and unless new beliefs are available to replace the old ones and unless there is a change in the larger system, teachers may not be responsive.
3. It is gratifying to note the heads of departments and principals are currently being trained in IT use and management by the MOE. This must be conscientiously sustained and followed up. Like teachers, the principals too may have their own fears and concerns, which need to be addressed, and unless the leadership is confident and clear about the role of IT, their own lack of focus may be translated to the rest of the school.
4. Schools need to develop a shared vision to sustain the teachers and the leadership's efforts in the initial and difficult implementation process of change. This is extremely important as it is at the individual level that change does or does not change.
5. Diffusion of IT entails a process of educational change. Time must be given for each of the stages of change to take place for without which, teachers will perceive the use of IT as another project that is grafted on to the school and not something of which they could have ownership.

   Meanwhile, the MOE may want to consider the following:

1. Tap the experiences of the GEP. For more than a decade, these selected teachers have been involved in curriculum design and development. It is the researcher's understanding that past and present GEP teachers, more than any other teachers, have been given opportunities to experiment and to reflect. Among the GEP teachers too, several would already have been exploiting the use of IT in their project work with the pupils.

2. Collaboration among teachers from different schools could be more actively encouraged as such sharing and working in teams across schools would build up a learning culture among members of the profession.

3. With schools given more autonomy ("More Resources," 1997), the quality of school leadership is even more critical. Strong inspirational instructional leaders with good track records could be identified early and groomed for various leadership positions in the schools. Overseas attachments with schools strong in IT use could be organised for them. Sabbaticals for research and reflection awarded to outstanding school instructional leaders may strengthen the entire educational system. Singapore can learn from other countries like the United States and Canada in areas like organisation and collaboration.

4. Although NIE has, since the 1980s, provided an IT education programme, it is gratifying to note that since 1995 it has stepped up its programme for its pre-service training by giving more hours to its Instructional Technology course. Teacher education programmes, unlike in-service programmes, have the ability to reach future educators and to provide them with the amount of instruction that is required to successfully apply technology and they should continue to be strongly supported. That there is now an NIE IT committee actively looking into the cultivating of an IT culture in NIE is noteworthy and encouraging.

5. As commercial firms are invited to hold basic computer literacy classes for teachers under the IT Masterplan, MOE may have to ensure that these instructors are reasonably trained to do so.

6. MOE with its recent reform package seems to be making the needed changes in the educational system. MOE must however see that its agenda will continually support the specific kinds of instruction and intellectual inquiry that are compatible with the promises of IT. Teachers hence will want to see that there are indeed substantive changes like reduction of the curriculum content and the introduction of other assessment models. While a committee is working on this change, feedback from practising teachers at this stage may be useful too.

7. Linked to the teachers' stress that comes with change is perhaps the greater stress of dealing with seemingly frequent pronouncements from MOE about new initiatives. Even before teachers can adjust to one initiative is the uncertainty that yet another initiative may be forthcoming. Teachers in general may not appreciate the rationalisations by MOE of new initiatives even before the current one is successfully adopted, implemented and institutionalised (Fullan, 1991). As the IT Masterplan has high priority, MOE might want to give full support to schools of its implementation in ways the teachers appreciate.

Concluding Remarks

The School must rethink its mission starting with the unique needs of the pupils and a set of instructional goals before it can understand the ways in which IT can help its institutional goals. Meanwhile, the technology by itself is not the answer to greater creativity or independent thinking. The power of technology will come only from its combination with serious educational and curricular reforms, This means MOE must see that its agenda will continually support the specific kinds of instructions and intellectual inquiry and assessment models that are compatible with the promise of IT.

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