

## Evaluation of Implementation of the IT Masterplan 3 and its Impact on Singapore Schools

### Instrumentation and Baseline Study

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**THIS EVALUATION STUDY AIMED** to assess the implementation of the Third Masterplan for Information and Communication Technologies in Education (mp3) and its impact on Singapore schools through a 5-year survey of more than 8,000 participants and case studies of 12 schools. This research brief focuses on findings from the 2009 baseline study. In general, Singapore students reported high competencies in basic ICT skills and perceived themselves to be frequently engaged in self-directed learning (SDL) and collaborative learning (CoL) using ICT. Their perception of SDL revolved around achieving better academic results, and they tended to adopt a divide-and-conquer strategy for CoL. The teachers also reported high competencies in basic ICT skills. They tended to associate SDL with independent learning using ICT-mediated resources while associating CoL with group work. Recommendations are made on ways to harness ICT to enhance the achievement of the mp3 goals.

### INTRODUCTION

In August 2008, the Ministry of Education (MOE) launched the Third Masterplan for ICT in Education (mp3), aimed at preparing Singapore students for the 21st century. Working towards the vision of "Harnessing ICT for Future Learning", the four mp3 goals are:

1. For students: to possess competencies for self-directed learning (SDL) and collaborative learning (CoL) through the effective use of ICT as well as to become discerning and responsible ICT users.
2. For teachers: to have the capacity to plan and deliver ICT-enriched learning experiences for students to become self-directed and

### KEY IMPLICATIONS

- To facilitate self-directed learning among students, we could encourage them to set learning goals that emphasize deep understanding of subject content knowledge.
- To support collaborative learning, students can be encouraged to focus on achieving better understanding through collaborative meaning-making.
- Teachers should be encouraged to widen their repertoire of ICT-mediated pedagogies, such as the use of reflection tools and knowledge-building tools, and explore the potential of educational games, multimedia editing and immersive virtual environments.

- collaborative learners as well as nurture students to become discerning and responsible ICT users.
3. For school leaders: to provide direction and create conditions to harness ICT for teaching and learning.
  4. ICT infrastructure: able to support teaching and learning anywhere, anytime.

To monitor the progress of mp3, a 5-year longitudinal evaluation study was commissioned by MOE and a tripartite collaborative team comprising staff from the National Institute of Education and MOE's Educational Technology Division and Masterplan Project Office was established.

The study focused on both process and product, and served to be both formative and summative. The formative evaluation assessed the implementation processes and achievement of intermediate milestones in schools so that evidence-based recommendations could be provided to both schools and policymakers. The summative evaluation provided evidence for the overall achievement, values and worth of mp3 as well as recommendations for future masterplans.

## RESEARCH DESIGN

The study had a mixed-method design: a repeated cross-sectional survey was complemented by case studies of 12 schools. Table 1 summarizes how various data collection methods were used to answer the research questions.

The survey was used to assess the extent of achievement of the mp3 goals, by sampling the same level of students across 5 years. A stratified random sample of 8,400 students across 5 levels (P4, P5, S1, S3 and JC1) and streams/courses were selected, as well as school leaders, and 50% of the teachers in 50 primary, 50 secondary schools, and 10 junior colleges/centralized institute (JCs/CI) across school

types (which included government, government-aided, independent, LEAD ICT and FutureSchools).

For the case studies, 6 primary and 6 secondary schools were selected based on the baseline survey results. The same 12 schools were tracked for a more in-depth understanding of the participants' practice, perception, experience and progress over 5 years. The unit of analysis was a school rather than individual students.

The case studies employed methods such as lesson observations, interviews and focus group discussions to obtain rich and relevant information. In addition, relevant documents such as schemes of work, syllabuses and lesson plans (if any) were obtained to triangulate the findings from the observations.

## KEY FINDINGS

### *Students' Outcomes*

From the self-reported survey questionnaires, we found that students are generally competent in the use of ICT tools. Primary students are competent with the Internet and Microsoft Word, but less so with email and Microsoft Excel. Secondary and JC students are competent with information tools, office productivity tools and communication tools, but less so with educational games, reflection tools, collaboration tools, multimedia editing and immersive virtual environments.

The study found that students' ICT competencies and use of ICT are associated with the first mp3 goal. There is a strong positive relationship between students' use of ICT for school work and their engagement in SDL and CoL. There is also a positive relationship between their ICT competencies and engagement in SDL and CoL.

The self-reported survey also found favourable outcomes in terms of students' engagement in SDL

Table 1. Research questions and methods.

Research questions	Data collection method	Data analysis
To what extent are the four mp3 goals achieved by the students, teachers and leaders in schools over a 5-year period?	Survey questionnaires for principals, teachers and students.	Statistical analyses including descriptive statistics, <i>t</i> -test, ANOVA, and multi-level analysis.
What are the perceptions and experiences of school leaders, teachers and students of mp3?	Interviews with principals, teachers and students.	Thematic analysis of data from case studies. Focus on achievement of mp3 goals and impact on schools.
How do teachers in the selected schools use ICT for teaching and learning?	Classroom observation, post-lesson interviews, document analysis (e.g., lesson plan).	Thematic analysis of data from case studies. Focus on achievement of mp3 goals and impact on schools.
What are some key factors that contribute to the outcomes in various schools?	All of the above methods.	A combination of both quantitative and qualitative analyses.

and CoL, and the use of ICT for SDL and CoL. Students were found to be frequently engaged in SDL and CoL and frequently used ICT for these purposes. Primary school students engaged in SDL more frequently than secondary and JC students, but the reverse trend was observed for CoL.

The case studies, however, revealed that students' understanding of SDL and CoL could have inflated their perception of their engagement in SDL and CoL. Students' perception of SDL revolved around academic results: for example, setting goals related to examinations or future academic pursuits, and aiming to do more assessment practices to achieve better results.

Similar to the survey findings, we found that students commonly used the Internet to search for information or made use of resources available through the school's learning management system. They tended to associate CoL with group work or project work and usually adopted a divide-and-conquer strategy, rather than a collaborative meaning-making approach, for such tasks. In other words, they seemed to co-operate for task completion rather than to collaboratively advance their understanding of the subject knowledge. The tools commonly used were communication tools like MSN Messenger.

In terms of cyber wellness, primary school students were most closely watched by family members when using computers and they did not often disclose personal details online. These behaviours were less frequent among secondary students and least frequent among JC students.

### *Teachers' Outcomes*

The teachers' survey also revealed some positive outcomes in terms of engagement in SDL and CoL, ICT competencies, and the use of ICT for SDL and CoL.

Teachers reported frequently engaging their students in SDL and CoL activities. The majority of teachers are comfortable using existing ICT tools and resources to support classroom teaching, which is consistent with findings from the IT Masterplan 2. They reported very high competencies in core ICT skills, but reported less frequent use of ICT for SDL and CoL compared to the students. There was also a strong relationship between teachers' use of ICT and their students' engagement in SDL and CoL.

The self-reported survey results should be interpreted together with the findings from the case studies. The teachers tended to equate SDL with independent (unsupervised) learning using ICT. Common strategies include assigning learning or practice activities through the learning management system and resources provided by e-learning service providers, and searching for information on the Internet. Other aspects of SDL, like helping students to set goals and developing strategies to monitor their own progress, were not frequently observed or reported.

Teachers' perceptions of CoL corroborated with students' association of CoL with group work. It was not common to observe teachers providing explicit instructions to students on how they should work collaboratively or engage in meaning-making.

From the teachers' perspective, the top three obstacles in using ICT for learning and teaching were: (1) ICT-based lessons are time-intensive; (2) time allocated in the timetable for the lessons is insufficient; and (3) the use of ICT is not required in national examinations.

## **IMPLICATIONS**

### *For Policy*

Outcomes varied across school levels, suggesting that the nature of learning activities and students' needs could be different at different levels. For example, primary school students engaged in SDL more frequently, whereas JC students engaged in CoL more frequently. Thus, a differentiated approach might be necessary when providing support at different school levels.

Students' self-reported ICT competencies show that most students have achieved baseline ICT competency but there is room for improvement; for example, in the use of reflection tools or spreadsheet programs like Microsoft Excel. Raising competency in these tools may help to further enhance the achievement of mp3 goals. Likewise, the potential of educational games, multimedia editing and immersive virtual environments could be further explored. More effort could be invested in sharing research findings on the pedagogical and practical applications of these tools.

In terms of cyber wellness, higher level students tend to give their personal details more readily to people they have only met online. It might be necessary to

monitor JC students' awareness of releasing personal information online. There is a need to enhance their awareness about the risks and possible pitfalls of online behaviours.

As the obstacles to teachers' use of ICT in schools were largely related to time and assessment issues, its use would likely go up if ICT is integrated into assessment at the system level, and schools are provided with more relevant digital learning resources to reduce preparation time. Professional learning communities among the teachers could be set up to encourage sharing of good ideas and practices.

### *For Practice*

While the survey results show very positive outcomes for students' perceptions of SDL and CoL, findings from the case studies, however, show that there is room for improvement. In particular, students seem to focus on setting performance goals related to academic results (e.g., focusing on test scores rather than learning).

Research has shown that setting performance goals often leads to increased anxiety and an inability to persist when faced with obstacles. Conversely, setting learning goals results in adaptive responses, such as increased efforts to solve a problem, or greater perseverance when confronted with a difficult situation (Dweck, 1986; Dweck & Leggett, 1988). Thus, to facilitate students' SDL, there is a need to encourage them to set learning goals as opposed to performance goals.

In terms of CoL, students need to focus on achieving better understanding through collaborative meaning-making and knowledge-building (Scardamalia & Bereiter, 2006) rather than using a divide-and-conquer strategy for task completion.

### *For Teacher Training*

The use of ICT tools was found to be correlated with engagement in SDL and CoL. More effort could be invested in understanding the affordances of

the software and their corresponding applications to certain types of instructional activities (e.g., reflection tools for SDL). This could contribute to the identification of technological pedagogical content knowledge that teachers could use for designing ICT-based lessons.

The finding that both teachers and students were frequently engaged in SDL and CoL is encouraging. However, although teachers reported very high ICT competencies in the core ICT skills and were comfortable in using existing ICT tools and resources to support classroom teaching, their use of ICT for SDL and CoL was less frequent.

On the other hand, there is a strong relationship between teachers' use of ICT and students' engagement in SDL and CoL. Thus, if teachers' capacity in the use of ICT for SDL and CoL could be raised, there could likely be an increase in ICT-based learning opportunities for students possibly leading to greater student engagement in SDL and CoL.

Teachers' understanding of SDL and CoL could be further enhanced so that they can facilitate development of 21st century skills in their students. For example, they can help students to set learning goals and develop strategies to monitor their own progress, or to develop group process skills and facilitating collaborative meaning-making to deepen their understanding of content knowledge.

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