An Instrument for Self-evaluation of Students in Using Information Technology for Learning

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A web-based survey instrument was developed to measure the self-evaluated learning outcomes of Hong Kong students in terms of information technology (IT) proficiency, information literacy (IL) competence, and their perception of using IT for learning. One-hundred and forty primary and secondary schools and 12,235 students were randomly selected by a two-stage cluster sampling method to report on their skill levels of technology, knowledge of information processing using IT, and their beliefs about using IT for learning. The Cronbach's Alpha Reliability coefficient of the survey is 0.953. The findings show that students were generally proficient in IT skills and aware of the social and ethical issues involved in using IT. The students also indicated their positive beliefs and confidence in the use of IT for learning.

Keywords: Information literacy, information technology, school education, self-evaluation, student learning, survey instrument, web-based survey

INTRODUCTION

In Hong Kong, information technology in education (ITEd) is motivated by three developments in society. First, the exponential growth of knowledge since the twentieth century and the resulting knowledge economy means that local students need to acquire the ability to process information (Candy, 2002; Johnson, 2003). Second, with the increasing popularity of digital culture, learners must possess information and communication technology skills in response to the digitalization of all industries (Martin, 2003). Third, economic globalization illustrates that our students must develop global perspectives and be able to communicate and cooperate with people from different cultural backgrounds (O'Sullivan, 2002; Rader, 2003; World Summit on the Information Society, 2003).

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These three driving forces reveal that in the twenty-first century people need to master information processing skills for their learning, professional and personal activities by taking advantage of information technology (IT). In this regard, learners should be equipped not only with proficiency in the use of IT tools, but also with competence in processing information.

To equip our younger generation to face the challenge of the increasingly knowledge-based and competitive world of tomorrow and prepare them to cope with the changing needs of the information age, the government of Hong Kong has made a significant investment in ITEd in the past two decades. For ITEd curriculum development between the late 1980s and the 1990s, the foci fell on the development of students' IT skills and the establishment of an IT infrastructure in schools. Computer Literacy, introduced in 1986 for the junior secondary curriculum of Computer Studies, acted as an agent to encourage secondary students to acquire knowledge of IT applications (Kong, 2003). After the pledge to invest hugely in ITEd as stated in its 1997 Policy Address, the government announced the first strategic document, *Information Technology for Learning in a New Era: Five-year Strategy – 1998/99 to 2002/03*, to provide the essential infrastructure for ITEd in 1998 (Education and Manpower Bureau, 1998). To implement this ITEd strategy, the document *Information Technology Learning Targets* was issued in 2000 to stipulate the IT learning targets for students in different learning stages and to suggest guidelines for primary and secondary schools to embed IT in school education (Curriculum Development Council, 2000). A guideline entitled "Computer Awareness Programme" for primary schools was included in *Information Technology Learning Targets* (Curriculum Development Council, 2000, Appendix III) to ensure that students could achieve the IT learning targets at the stage of primary education.

Table 1. Key Events That Have Driven the Development of Students' IT Skills and IL Competence at Different Levels of Schooling in Hong Kong in Recent Decades

Year	Key event
1986	The Curriculum Development Institute established the curriculum of Computer Literacy for Junior Secondary.
1997	In *Policy Address*, the Chief Executive of the Government of Hong Kong Special Administrative Region announced a huge investment in ITEd in Hong Kong.
1998	The Government of Hong Kong Special Administrative Region issued the first strategic document, *Information Technology for Learning in a New Era: Five-year Strategy – 1998/99 to 2002/03*.
2000	The Curriculum Development Council of the Education Department issued a document entitled *Information Technology Learning Targets* to guide the implementation of ITEd in schools.
2000	The Education Department delivered a teaching kit to promote computer awareness in primary schools.
2001	The Curriculum Development Council of the Education Department issued the document *Learning to Learn – The Way Forward in Curriculum Development*, regarded the ability to use IT as an important element to develop and initiate lifelong learning as well as whole-person development.
2004	The Government of Hong Kong Special Administrative Region issued the second strategic document, *Empowering Learning and Teaching with Information Technology*.

For ITEd curriculum development during the 2000s, emphasis has been placed on the cultivation of information literacy (IL) by students in addition to the development of IT skills. IL refers to the mastery of knowledge that is necessary for information processing, and the cultivation of a proper attitude toward information processing (Kong, 2007). The document *Learning to Learn – The Way Forward in Curriculum Development* issued in 2001 affirmed that the generic skills inherent in IL can be developed through the use of IT in the learning of different subjects or key learning areas (KLAs) (Curriculum Development Council, 2001). The second strategic document on ITEd entitled *Empowering Learning and Teaching with Information Technology* was issued in 2004 (Education and Manpower Bureau, 2004). The foci of this ITEd strategy were to guide school principals and teachers in the integration of IT into learning and teaching, and to develop the appropriate skills, knowledge, and attitudes in learners to ensure lifelong learning. The use of IT with the integration of IL in school education was proposed to equip students with the necessary skills and proper attitudes toward using IT for information processing. Table 1 summarizes the key events that have driven the development of students' IT skills and IL competence at different levels of schooling in Hong Kong in recent decades (Kong, 2003).

THE DEVELOPMENT OF THE SURVEY INSTRUMENT

In the latest ITEd strategy, the second ITEd strategy *Empowering Learning and Teaching with Information Technology* which has been implemented since 2004, one of the important goals is "empowering learners with IT". This goal aims at equipping students with "the necessary skills, knowledge and attitude for lifelong learning and creative problem solving in the information age". Students are encouraged to use IT as an "information retrieval, knowledge enquiry, communication, collaboration, analytical and personal development tool". As the government of Hong Kong has made a significant investment in the promotion of ITEd, it is important to allow the public to have an idea of how effective various ITEd initiatives on learning have been. To address the need for further research and evaluation of the effectiveness of the ITEd strategy for achieving the goal "empowering learners with IT", a region-wide evaluation study was planned to review the progress of this ITEd strategy in Hong Kong. Since students are the central concern of school education, it is vital to collect students' views in the evaluation study. In this regard, the design of an appropriate survey instrument to investigate the effectiveness of ITEd strategies was proposed for this evaluation study.

In order to collect quantitative information about students' perceptions of the use of IT in learning, an instrument was developed in light of the relevant previous studies (Education and Manpower Bureau, 2001, 2005). The instrument of this evaluation study included three evaluation themes for the question items: IT proficiency, IL competence, and perception of learning with IT.
For the first evaluation theme, the target of evaluation was proficiency in computing skills. Two variables, proficiency in using software and proficiency in using hardware, were designed for students to self-evaluate their IT proficiency.

For the second evaluation theme, the target of evaluation was competence in IL. Students' levels of confidence in the use of IT to perform tasks in information processing, and students' views on the social and ethical issues involved in various computer-related activities were the variables for students' self-evaluation of their IL competence.

For the third evaluation theme, there were two targets of evaluation for students to express their views on using IT for learning. The first was beliefs and attitudes toward the use of IT for learning; the second was confidence in the use of IT for learning. Regarding

beliefs and attitudes toward the use of IT for learning, three variables were involved. Students' levels of agreement about their learning outcome as derived from learning with IT was designed as a variable to measure students' perceptions of learning outcomes derived from learning with IT; while the extent of students' interest in exploring innovative IT and the extent of students' willingness to use more IT for learning were the other two variables to measure students' attitudes toward the use of IT in the learning process. Concerning confidence in the use of IT for learning, the variable involved was students' levels of confidence in the use of IT to perform respective computing tasks in the learning process. Details of the question items in relation to these three themes can be found in the Appendix of this article.

A web-based questionnaire entitled "Students' Information Technology in Education Questionnaire (Students' ITEd Questionnaire)" was established on the online platform "Self-evaluation Platform (SEP) on ITEd for Schools" provided by the EMB for online data collection activities. A web-based approach was chosen in this study because it enabled a larger number of questionnaires to be processed at the same time at comparatively low cost. In addition, as shown in many research reports, there was no difference in reliability between an online survey and a traditional paper-based survey (Kaplowitz, Hadlock & Levine, 2004; Perkins, 2004). The anonymous questionnaire was conducted via a self-administered approach. Respondents were asked to rate the question items in the form of *5-point Likert Scale*.

To safeguard the validity of the evaluation instrument, the question items developed by the experts in the research team were reviewed by local consultants, honorable advisors, and representatives from the EMB for further refinement before the pilot study. After the pilot study, refinements were made before the instrument was used for data collection.

METHODOLOGY ON CONDUCTING THE SURVEY

Gay & Airasian (2003) proposed that the use of a structured questionnaire conducted with a proper sampling method and under strict administrative procedures will yield reliable results and facilitate generalization. The participants of this questionnaire survey were selected students of particular grades in the primary and secondary school sectors. For students in the primary school sector, only those in Primary 4 (P4) and Primary 6 (P6) were surveyed. For students in the secondary school sector, only those in Secondary 2 (S2), Secondary 4 (S4), and Secondary 6 (S6) were surveyed. The selection of a particular grade of students for sampling was based on the following four factors: the key stages of IT learning targets; the comparability of data collected in the relevant previous studies; the reading and comprehension abilities of the Primary 1 to Primary 3 students; and the stringent teaching schedules of the Secondary 5 and Secondary 7 students.

A two-stage cluster sampling procedure was adopted for selecting students in each school sector in this study (Kish, 2005), which included 623 primary schools and 471 secondary schools in Hong Kong. Sixty-eight primary schools and 72 secondary schools were randomly selected at the first stage. Of all the sampled schools, one class from each P4 and P6 levels of primary school, or one class from the S2, S4, and S6 levels of secondary school, were randomly selected at the second stage. The actual sample sizes of students for primary and secondary sectors were 4,423 and 7,812 respectively.

For the two-stage cluster sampling in this survey, weightings were applied based on the direct proportion to the inverse of the selection probability of each student. Both the size of schools and classes were taken into consideration. The weighting scores were then used to adjust the data of the Students' ITEd Questionnaire for further analysis. The weighting is formulated as follows:

The weighting score of a class level of a sampled school	$= \dfrac{x_i}{y_i} \times \dfrac{\sum_{i=1}^{n} y_i}{\sum_{i=1}^{n} x_i}$ where	x_i is the total number of students of the class level of the sampled school, y_i is the number of respondents of the selected class of the class level of the sampled school, n is the total number of sampled schools of a school sector.

There were two stages to the implementation of the survey instrument. The first stage was the pilot study over a span of two months. It aimed to test the feasibility of the web-based questionnaire as well as to try out the instruments to uncover any possible areas for improvement. Three major revisions were made to finalize the questionnaire after the pilot study. First, new items were added to the pilot questionnaire to tap information related to important variables. Second, the wording or options of some question items were modified to improve clarification and enhance the appropriateness of the options given. Third, the questionnaire was structured with an appropriate logical sequence and length.

The second stage was the main study which took place over a span of three months. The finalized questionnaire was uploaded to the designated online platform for the anonymous web-based questionnaire. Students received information about account names and passwords through their school coordinators. Students were required to complete the questionnaire themselves anywhere, anytime. It is noteworthy that although login accounts and passwords were required, the identities of the respondents were not revealed. Any identification of group responses such as the school code and class level was used for tracking the response rate only. In addition, the system instantly aggregated the individual data of respective respondents so that retrieval of individual data was impossible.

Five quality control (QC) measures were adopted in this evaluation study. First, all question items except those involving personal information in the online questionnaires had to be answered by the respondents. Second, submission of incomplete questionnaires (except items about personal information) was not allowed in the SEP. The system also conducted security checks to ensure that respondents could not submit the questionnaires more than once. Third, clear instructions which explained that the questionnaires were anonymous were given to encourage respondents to give "true" responses, though respondents needed to login to the platform using personal accounts. Fourth, online help and hotline inquiry were available when respondents had difficulties in completing the questionnaires. Fifth, it was suggested to school coordinators/representatives that they gather together students in groups to do the online questionnaires in school computer rooms. The first two measures aimed at preventing the occurrence of item nonresponse in this evaluation study. The remaining three measures aimed at maintaining a relatively high response rate in this evaluation study because achieving the target response rate is important for a quantitative survey to ensure the representativeness of a target population. Consequently, the response rates to the Students' ITEd Questionnaire Survey in primary and secondary sectors were 85% and 79% respectively (see Table 2). The Cronbach's Alpha Reliability coefficient of the questionnaire survey is 0.953.

There was an assumption in this article that the 5-point Likert scales adopted in the survey belonged to the continuous measurement with equal intervals between each of the attributes. Although there is controversy about the use of a parametric analytical approach to analyze Likert scale data (Jamieson, 2004; Pell, 2005), this article adopted the parametric analytical approach to report the results of the survey for comprehensible

data presentation across the five class levels with regard to the large sample size of the survey.

Table 2. Response Rates to the Students' ITEd Questionnaire Survey in Primary and Secondary School Sectors

School sector	Questionnaire Language		Sampled Students	Responded Students		Total Responded Students	Response Rate	Target Response Rate
	English	Chinese		English	Chinese			
Primary	0	4432	4432	0	3739	3739	85%	80%
Secondary	111	7701	7812	100	6089	6189	79%	80%

RESULTS AND DISCUSSIONS

As mentioned, the study reported herein was to devise an instrument to measure the self-evaluated learning outcomes of students in terms of three aspects, viz. IT proficiency, IL competence, and perception of using IT for learning. This section presents and discusses students' self-evaluation results on the question items in these three evaluation aspects.

IT PROFICIENCY

There were two variables in this evaluation aspect: proficiency in using software and proficiency in using hardware. The findings show that students were generally proficient in software and hardware skills.

Table 3
Students' Self-evaluated Levels of Proficiency in Software Use

Software	P4		P6		S2		S4		S6	
	M $(1\text{-}5)^a$	SD	M $(1\text{-}5)^a$	SD	M $(1\text{-}5)^a$	SD	M $(1\text{-}5)^a$	SD	M $(1\text{-}5)^a$	SD
d. Online communication software (e.g. e-mail)	3.50	1.32	3.98	1.04	3.95	0.93	3.98	0.86	3.99	0.84
e. Online information searching tools (e.g. browser, search engine)	3.50	1.31	3.92	1.07	3.91	0.96	3.97	0.89	3.99	0.89
b. Spreadsheet	3.37	1.32	3.53	1.08	3.44	0.95	3.35	0.91	3.14	0.95
a. Word processing software	3.36	1.31	3.54	1.11	3.59	0.93	3.59	0.89	3.65	0.87
g. Computer graphic design (e.g. drawing and photo editing)	3.31	1.37	3.53	1.14	3.35	1.04	3.19	1.05	2.79	1.13
k. Chinese input	3.20	1.31	3.42	1.22	3.54	1.13	3.61	1.08	3.64	1.09
c. Presentation software	3.17	1.34	3.78	1.03	3.76	0.92	3.73	0.85	3.57	0.88
f. Web design/editing software	3.03	1.41	3.27	1.23	3.13	1.06	3.03	1.05	2.66	1.17
h. Multimedia design software (e.g. animation design)	3.00	1.45	3.23	1.28	2.96	1.15	2.81	1.08	2.28	1.16
j. Audio/Video editing software (e.g. editing and file format conversion)	2.96	1.41	3.16	1.27	2.94	1.21	2.86	1.17	2.47	1.24
i. Programming (e.g. Logo and Java)	2.94	1.43	3.05	1.31	2.79	1.19	2.58	1.14	2.14	1.16

Note. [a] A 5-point Likert scale where 1 = "Know nothing at all" and 5 = "Highly proficient".

The surveyed primary and secondary school students indicated that they were proficient in the necessary knowledge about IT and the basic concepts and skills in

contemporary computing technologies in relation to their corresponding key learning stages. In general, the majority of the surveyed students expressed that they were proficient in using IT tools which are designed for communication and information searching purposes. The students also indicated that, however, they were less proficient in using emerging technologies. Tables 3 and 4 show students' self-evaluated levels of their proficiencies in software and hardware use.

Table 4. Students' Self-evaluated Levels of Proficiency in Hardware Use

Hardware	P4		P6		S2		S4		S6	
	M (1-5)[a]	SD	M (1-5)[a]	SD	M (1-5)[a]	SD	M (1-5)[a]	SD	M (1-5)[a]	SD
j. Use of Keyboard	3.62	1.32	3.97	1.08	4.00	0.91	3.97	0.91	3.94	0.89
h. Portable Computer Game Devices	3.24	1.46	3.58	1.28	3.40	1.23	3.19	1.23	2.87	1.27
a. Printer	3.21	1.46	3.63	1.24	3.76	1.01	3.73	0.94	3.72	0.92
c. Digital Camera	3.19	1.45	3.48	1.30	3.53	1.17	3.56	1.12	3.57	1.09
b. CD-ROM (CD-R or DVD-R) Writer	3.09	1.45	3.42	1.28	3.56	1.12	3.58	1.08	3.58	1.05
g. Network Devices (e.g. Domestic Network Devices)	3.05	1.49	3.39	1.32	3.37	1.22	3.21	1.17	2.92	1.20
i. Portable Multi-media Player Devices	3.05	1.48	3.44	1.29	3.43	1.20	3.33	1.19	3.06	1.23
d. Digital Video Recorder	3.02	1.48	3.25	1.34	3.20	1.24	3.15	1.18	2.91	1.25
e. Scanner	2.83	1.48	3.15	1.33	3.18	1.26	3.23	1.20	3.14	1.20
f. Mobile Devices [e.g. Pocket Personal Computer (PC) or Personal Digital Assistant (PDA)]	2.81	1.48	3.04	1.38	2.93	1.29	2.79	1.22	2.52	1.27

Note. [a] A 5-point Likert scale where 1 = "Know nothing at all" and 5 = "Highly proficient".

In summary of Tables 3 and 4, the primary and secondary school students were proficient in using "online communication software", "online information searching tools", "keyboard", and "printer"; but were less proficient in using "audio or video editing software", "multi-media design software", "programming", "scanner", and "mobile devices".

IL COMPETENCE

To evaluate students' IL competence, students were asked to express their confidence in the use of IT to perform tasks in information processing, as well as their views on the social and ethical issues involved in various computer-related activities.

As for the perceived levels of confidence in using IT to perform different tasks in information processing, the majority of the surveyed students rated themselves as confident or very confident in "information search" and "information selection" with the use of IT. In contrast, using IT for "information collation and analysis" and "reporting and presentation" were the weakest areas perceived by the surveyed primary school students; while secondary school students indicated that they were less confident in using IT for "self-evaluation on learning outcomes". Table 5 shows students' levels of confidence in using IT to perform different tasks in information processing.

Table 5. Students' Self-perceived Level of Confidence in Using IT to Perform Different Tasks in Information Processing

Task in information processing	P4		P6		S2		S4		S6	
	M (1-5)[a]	SD	*M* (1-5)[a]	SD	*M* (1-5)[a]	SD	*M* (1-5)[a]	SD	*M* (1-5)[a]	SD
a. Information search (e.g. using search engine)	3.83	1.10	4.03	0.96	3.89	0.88	3.88	0.84	3.92	0.80
b. Information selection	3.56	1.09	3.69	0.98	3.54	0.86	3.54	0.84	3.56	0.83
e. Self-evaluation on learning outcomes (e.g. online tests/questionnaires/learning records)	3.65	1.18	3.71	1.03	3.48	0.90	3.44	0.87	3.38	0.88
c. Information collation and analysis (e.g. using spreadsheet)	3.49	1.15	3.68	1.01	3.50	0.88	3.48	0.86	3.50	0.86
d. Reporting and Presentation (e.g. PowerPoint and website presentation)	3.43	1.21	3.69	1.04	3.56	0.94	3.56	0.91	3.57	0.91

Note. [a] A 5-point Likert scale where 1 = "Totally not confident" and 5 = "Very confident".

The results also reflect that the surveyed students generally showed themselves as responsible users of IT. The responses, as shown in Table 6, illustrate that there is a reasonable level of awareness of the social and ethical issues relating to the use of IT.

Table 6. Students' Attitudes toward Social and Ethical Issues Related to the Use of IT

Social and ethical issue with the use of IT	P4		P6		S2		S4		S6	
	M (1-5)[a]	SD	*M* (1-5)[a]	SD	*M* (1-5)[a]	SD	*M* (1-5)[a]	SD	*M* (1-5)[a]	SD
b. Beware of e-mail bombs or the spread of computer viruses	3.70	1.46	3.90	1.29	3.96	1.13	4.02	1.01	4.15	0.93
a. Avoid spending long hours on computer/online games	3.64	1.33	3.52	1.25	3.37	1.12	3.60	1.00	3.85	0.94
c. Sending/forwarding unnecessary e-mails/messages	3.01	1.55	2.90	1.49	2.88	1.34	2.74	1.34	2.60	1.39
e. Using pirated (reproduced) software	2.18	1.46	2.25	1.36	2.65	1.20	2.72	1.14	2.76	1.05
d. Surfing pornographic websites	2.13	1.49	2.00	1.38	2.18	1.29	2.32	1.28	2.38	1.22
f. Disclosing personal particulars to strangers online	2.12	1.46	2.07	1.36	2.30	1.25	2.37	1.21	2.31	1.24

Note. [a] A 5-point Likert scale where 1 = "Strongly disagree" and 5 = "Strongly agree".

A large proportion of the surveyed students agreed to "beware of e-mail bombs or the spread of computer viruses" and "avoid spending long hours on computer or online games". However, the surveyed students were less concerned about the inappropriateness of "sending or forwarding unnecessary e-mails or messages" and "using pirated software".

PERCEPTION OF USING IT FOR LEARNING

To investigate students' perception of using IT for learning, students were asked to indicate their perception of learning outcomes derived from learning with IT, their confidence in using IT to perform respective computer tasks in the learning process, their extent of interest in using emerging innovative IT, and their extent of willingness to use more IT for learning. Regarding the perceived impact of IT on students' learning outcomes, students showed very positive perceptions of learning with IT. Their levels of agreement about the learning outcome as derived from learning with IT are depicted in Table 7.

Table 7. Students' Levels of Agreement about the Learning Outcomes as Derived from the Learning with IT

Learning outcome derived from learning with IT	P4		P6		S2		S4		S6	
	M (1-5)[a]	SD	*M* (1-5)[a]	SD	*M* (1-5)[a]	SD	*M* (1-5)[a]	SD	*M* (1-5)[a]	SD
a. Enhance academic performance	3.78	1.07	3.56	0.97	3.38	0.85	3.29	0.81	3.23	0.79
c. Enhance interest in self-learning of subject content	3.78	1.04	3.66	0.94	3.47	0.86	3.47	0.84	3.52	0.83
b. Strengthen understanding of subject knowledge	3.72	1.02	3.61	0.92	3.49	0.83	3.51	0.79	3.56	0.78
i. Widen perspective through more interaction with the outside world	3.69	1.13	3.72	1.01	3.59	0.92	3.61	0.93	3.63	0.89
f. Enhance creativity	3.68	1.10	3.58	0.99	3.34	0.91	3.29	0.85	3.17	0.89
d. Enhance planning and learning management skills	3.67	1.05	3.53	0.92	3.35	0.82	3.31	0.80	3.25	0.81
h. Provide opportunities for collaborative learning	3.65	1.11	3.60	0.99	3.43	0.91	3.38	0.91	3.22	0.89
e. Enhance information processing ability	3.63	1.07	3.58	0.93	3.44	0.83	3.45	0.80	3.54	0.81
g. Enhance communication and presentation skills	3.57	1.11	3.50	0.98	3.30	0.92	3.20	0.91	3.02	0.94

Note. [a] A 5-point Likert scale where 1 = "Strongly disagree" and 5 = "Strongly agree".

For P4 students, the major positive impacts of the use of IT in learning were to "enhance academic performance" and "enhance interest in self-learning of subject content". For P6 and secondary school students, the use of IT in learning was particularly helpful to "widen perspective through more interaction with the outside world". In contrast, the effect of using IT to "enhance communication and presentation skills" was found to be the outcome rated the lowest by students.

As for the computing tasks in the learning process, the surveyed students indicated their high level of confidence in "English input via the computer" and "searching for information on the Internet". However, they had less confidence in "using e-learning platform to conduct learning activities". Students' levels of confidence in the use of IT to perform respective computing tasks are shown in Table 8.

Table 8. Students' Self-perceived Level of Confidence in Using IT to Perform Respective Computing Tasks

Computing task	P4 M (1-5)[a]	SD	P6 M (1-5)[a]	SD	S2 M (1-5)[a]	SD	S4 M (1-5)[a]	SD	S6 M (1-5)[a]	SD
d. Using computer to conduct entertaining activities (e.g. playing computer games)	3.93	1.17	4.14	1.00	4.04	0.93	4.01	0.93	4.01	0.92
b. English input via the computer	3.86	1.18	4.01	1.02	3.97	0.92	4.01	0.89	4.06	0.85
e. Using the computer for daily activities (e.g. reading online newspapers)	3.67	1.22	3.92	1.04	3.79	0.92	3.94	0.92	4.01	0.86
g. Searching information on the Internet	3.67	1.22	4.00	1.03	3.94	0.91	4.02	0.88	4.06	0.85
a. Chinese input via the computer	3.55	1.26	3.60	1.15	3.66	1.07	3.75	1.04	3.74	1.00
i. Using the Internet/other digital resources to conduct learning activities assigned by teachers	3.54	1.21	3.70	1.06	3.52	0.93	3.51	0.91	3.45	0.90
c. Using the computer for learning (e.g. browsing electronic books)	3.52	1.23	3.66	1.10	3.51	0.92	3.58	0.91	3.62	0.94
h. Using the Internet/other digital resources to conduct self-learning activities	3.52	1.21	3.72	1.05	3.52	0.94	3.54	0.90	3.50	0.90
f. Using the computer to store/retrieve digital resources (e.g. uploading and downloading files)	3.51	1.25	3.79	1.11	3.85	0.96	3.97	0.93	3.99	0.90
j. Using e-learning platform to conduct learning activities (e.g. browsing documents, submitting assignments and after school discussion)	3.38	1.32	3.49	1.17	3.37	1.04	3.34	1.00	3.21	1.03

Note. [a] A 5-point Likert scale where 1 = "Totally not confident" and 5 = "Very confident".

Students' attitudes toward the use of IT in the learning process were reflected by their interest in exploring innovative IT hardware and software, as well as their willingness to allocate more time for using IT for learning. Tables 9 and 10 show the extent of students in these two aspects.

Table 9. Students' Interest in the Use of Emerging Innovative IT Tools, Techniques, and Applications

Evaluation item	P4 M (1-5)[a]	SD	P6 M (1-5)[a]	SD	S2 M (1-5)[a]	SD	S4 M (1-5)[a]	SD	S6 M (1-5)[a]	SD
Level of interest in the use of emerging innovative IT tools, techniques and applications	3.77	1.07	3.84	0.99	3.37	1.06	3.34	1.01	3.29	0.98

Note. [a] A 5-point Likert scale where 1 = "Not interested at all" and 5 = "Very interested".

Table 10. Students' Willingness to Allocate More Time for Using IT for Learning

Evaluation item	P4		P6		S2		S4		S6	
	M (1-5)[a]	SD	*M* (1-5)[a]	SD	*M* (1-5)[a]	SD	*M* (1-5)[a]	SD	*M* (1-5)[a]	SD
Level of willingness to allocate more time for using IT for learning	3.72	1.03	3.73	0.97	3.24	0.98	3.25	0.91	3.15	0.91

Note. [a] A 5-point Likert scale where 1 = "Totally not willing" and 5 = "Very willing".

The surveyed students generally had a positive attitude toward the use of IT in their learning process. A large proportion of the students, particularly those in the primary school sector, expressed interest in the use of emerging innovative IT tools, techniques, and applications (see Table 9). They also showed their willingness to allocate more time for using IT for learning (see Table 10).

CONCLUSION

A self-developed instrument in the form of a web-based questionnaire was adopted in a region-wide survey of ITEd in Hong Kong to measure the self-evaluated learning outcomes of students in terms of IT proficiency, IL competence, and perception of using IT for learning. Through a pilot study and a rigorous process of refinement with local consultants and government officials in the field of ITEd, an anonymous questionnaire based on the relevant previous studies was designed for students in the grades from junior primary to senior secondary to self-report their skill levels of technology, attitudes toward information processing with the use of IT, and beliefs about using IT for learning. By using a two-stage cluster sampling method, 140 primary and secondary schools and 12,235 students were randomly selected for the survey. The Cronbach's Alpha Reliability coefficient of the survey is 0.953.

The findings show that students were generally proficient in software and hardware skills. The majority of the surveyed students showed awareness of the social and ethical issues involved in using IT. The students generally believed that IT had a positive impact on their learning. Most of them were willing to use and confident in using IT for learning. The students also showed interest in exploring innovative IT.

The instrument developed in this study has established a mechanism to track the progress of various ITEd initiatives or projects and retrieve useful information at student-level from a data bank for upkeeping and analyzing relevant data for subsequent continuous evaluation. The instrument adopted in this study and the corresponding findings will be used by the subsequent region-wide study for the evaluation of the overall effectiveness of the second ITEd strategy in the academic year 2006/07. By using an identical instrument in these studies, it is anticipated that comparable data on the effectiveness of the second ITEd strategy from the perspective of students can be collected to inform future policies for the betterment of ITEd strategies in Hong Kong school education.

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Appendix A
QUESTION ITEMS FROM THE "STUDENT'S INFORMATION TECHNOLOGY IN EDUCATION QUESTIONNAIRE SURVEY"

Information Technology (IT) Proficiency

Question 1: Indicate your level of proficiency in using the following software (on a 5-point Likert scale where 1 is "know nothing at all" and 5 is "highly proficient")
a. Word processing software
b. Spreadsheet
c. Presentation software
d. Online communication software (e.g. e-mail)
e. Online information searching tools (e.g. browser, search engine)
f. Web design/editing software
g. Computer graphic design (e.g. drawing and photo editing)
h. Multi-media design software (e.g. animation design)
i. Programming (e.g. Logo and Java)
j. Audio/Video editing software (e.g. editing and file format conversion)
k. Chinese input

Question 2: Indicate your level of proficiency in using the following hardware (on a 5-point Likert scale where 1 is "know nothing at all" and 5 is "highly proficient")
a. Printer
b. CD-ROM (CD-R or DVD-R) Writer
c. Digital Camera
d. Digital Video Recorder
e. Scanner
f. Mobile Devices [e.g. Pocket Personal Computer (PC) or Personal Digital Assistant (PDA)]
g. Network Devices (e.g. Domestic Network Devices)
h. Portable Computer Game Devices
i. Portable Multi-media Player Devices
j. Use of Keyboard

Information Literacy (IL) Competence

Question 3: Indicate your level of confidence in using IT for the following tasks in information processing (on a 5-point Likert scale where 1 is "totally not confident" and 5 is "very confident")
a. Information search (e.g. using search engine)
b. Information selection
c. Information collation and analysis (e.g. using spreadsheet)
d. Reporting and Presentation (e.g. PowerPoint and website presentation)
e. Self-evaluation on learning outcomes (e.g. online tests/questionnaires/learning records)

Question 4: Indicate your level of agreement about the following descriptions of using IT (on a 5-point Likert scale where 1 is "strongly disagree" and 5 is "strongly agree")
a. Avoid spending long hours on computer/online games
b. Beware of e-mail bombs or the spread of computer viruses
c. Sending/forwarding unnecessary e-mails/messages

d. Surfing pornographic websites
e. Using pirated (reproduced) software
f. Disclosing personal particulars to strangers online

Perception of Using IT for Learning

Question 5: Indicate your level of agreement about these learning outcomes as derived from learning with IT (on a 5-point Likert scale where 1 is "strongly disagree" and 5 is "strongly agree")
a. Enhance academic performance
b. Strengthen understanding of subject knowledge
c. Enhance interest in self-learning of subject content
d. Enhance planning and learning management skills
e. Enhance information processing ability
f. Enhance creativity
g. Enhance communication and presentation skills
h. Provide opportunities for collaborative learning
i. Widen perspective through more interaction with the outside world

Question 6: Indicate your level of confidence in using IT for the following computing tasks (on a 5-point Likert scale where 1 is "totally not confident" and 5 is "very confident")
a. Chinese input via the computer
b. English input via the computer
c. Using the computer for learning (e.g. browsing electronic books)
d. Using computer to conduct entertaining activities (e.g. playing computer games)
e. Using the computer for daily activities (e.g. reading online newspapers)
f. Using the computer to store/retrieve digital resources (e.g. uploading and downloading files)
g. Searching information on the Internet
h. Using the Internet/other digital resources to conduct self-learning activities
i. Using the Internet/other digital resources to conduct learning activities assigned by teachers
j. Using e-learning platform to conduct learning activities (e.g. browsing documents, submitting assignments and after school discussion)

Question 7: Indicate your extent of interest in the use of emerging innovative IT (on a 5-point Likert scale where 1 is "not interested at all" and 5 is "very interested")

Question 8: Indicate your extent of willingness to allocate more time for using IT for learning (on a 5-point Likert scale where 1 is "totally not willing" and 5 is "very willing")