

Executive Summary

As technology continually advances, the importance of Information and Communication Technology (ICT) increases. According to the Organization for Economic Co-operation and Development (OECD), around 14% of today's jobs might be replaced by automation¹. Embracing the future and enhancing students' capabilities through an all-rounded ICT education is essential, especially at Junior Secondary Level.

Countries all around the world have been putting tremendous effort into catching up with technological advancement when reviewing the development of their school curricula; Hong Kong is no exception. The Chief Executive Mrs. Carrie Lam listed STEM education as one of the important ways to foster the development of technology in Hong Kong as part of her debut 'Policy Address'².

In addition, Information Technology (IT) is also labelled as one of the 9 Generic Skills that are essential for Hong Kong students to master³. At the moment, all Hong Kong students are required to study ICT as a compulsory subject up to Form 3; becoming an elective subject at Senior Secondary Level.

However, as revealed by the International Computer and Information Literacy Study (ICILS) 2013, Hong Kong students' performance in transforming, creating and sharing information was below the international average⁴, with a mean computer and information literacy score of 509 (categorized as level 2 in the 5-level system of proficiency⁵).

Furthermore 38% of students' performance was also categorized as

¹ Organization for Economic Co-operation and Development (2018). Putting faces to the jobs at risk of automation. *Policy Brief On The Future of Work*. March 2018. P.1. Retrieved from <https://www.oecd.org/employment/Automation-policy-brief-2018.pdf>

² The HKSAR Government (2017). *Policy Address 2017*. Paragraph 79.

³ The Curriculum Development Council (2017). *Key Learning Curriculum Guide (Primary 1 – Secondary 6) – Technology Education*.

⁴ The University of Hong Kong. (2014) International Computer and Information Literacy Study (ICILS) 2013: Hong Kong and international results. Retrieved 30th May, 2019 from <https://www.hku.hk/press/press-releases/detail/11981.html>

⁵ The study categorized Level 2 proficiency as students can use computers to complete basic and explicit information gathering and management tasks, and make basic edits, and add content, to existing information products in response to specific instructions.

“level 1 or below” which, as a proportion, was far higher than other developed countries such as Australia and Germany⁶.

Being the last learning stage as a compulsory subject, the Junior Secondary curriculum should provide fundamental skills for students, enabling them to develop a life-long interest in ICT.

This research paper (by collecting data from students, teachers and ICT education experts), takes a two-fold approach: 1) review schools’ ICT education and implementation strategies; 2) propose possible measures to enhance the effectiveness of ICT education at Junior Secondary Level.

Main Discussion

- 1. ICT education at Junior Secondary Level plays an important role in developing students’ problem-solving skills and the ability to adopt tools for learning and use in daily life. It also helps to enhance information literacy while enabling students’ life-long learning in the field.**

Combining the opinions of students, teachers and experts, ICT education at Junior Secondary Level has the following functions:

- (a) Developing students’ ability to adopt ICT tools for learning and daily use**

According to the result of the school survey, the majority of the 101 teachers surveyed said they expect students to be able to adopt ICT tools to ‘help them learn’ (99.0%) and ‘for daily life’ (96.0%), matching the learning objective listed in the curriculum guide⁷.

Emphasising ICT education at Junior Secondary Level, the interviewed experts all agreed with the Curriculum Development Council’s (the Council) designation of ‘Experiencing & Application’ as the ultimate

⁶ The University of Hong Kong. (2014) International Computer and Information Literacy Study (ICILS) 2013: Hong Kong and international results. Retrieved 30th May, 2019 from <https://www.hku.hk/press/press-releases/detail/11981.html>

⁷ The Curriculum Development Council (2017). *Key Learning Curriculum Guide (Primary 1 – Secondary 6) – Technology Education*. P.54.

goal of ICT education⁸.

(b) Enhancing students' information literacy

As information overload is common in the cyber world, every internet-user should have the ability to identify, organize and present information correctly, and to use ICT tools in an ethical manner⁹.

As shown in the International Computer and Information Literacy Study (ICILS) 2013, though, Hong Kong students' performance was only categorised as level 2 in a 5-level system, worse than other developed countries. When it comes to the proficiency of integrating and presenting information, Hong Kong students' performance was below the international average¹⁰.

Despite being significantly later than some other countries, 'strengthening students' information literacy' has been added to the 2017 curriculum guide as an important mission of ICT education¹¹. To support the current policy, it is important to consider other ways to strengthen information literacy to make sure our youth can be wise and responsible ICT users, as it becomes more important in and for the future.

(c) Developing students' problem-solving skills

The Council has repeatedly stated that developing students' problem-solving skills is an important aim of ICT education¹². All of the interviewed experts agreed; developing students' ability to use ICT tools in assisting problem solving, is important.

⁸ The Curriculum Development Council (2017). *Key Learning Curriculum Guide (Primary 1 – Secondary 6) – Technology Education*. P.9.

⁹ Summarized from the HKSAR's definition of Information Literacy. Education Bureau. (2018). *Information Literacy for Hong Kong Students*. Retrieved 30th May, 2019 from <https://www.edb.gov.hk/attachment/en/edu-system/primary-secondary/applicable-to-primary-secondary/it-in-edu/Information-Literacy/IL20180516E.pdf>

¹⁰ The University of Hong Kong. (2014) International Computer and Information Literacy Study (ICILS) 2013: Hong Kong and international results. Retrieved 30th May, 2019 from <https://www.hku.hk/press/press-releases/detail/11981.html>

¹¹ The Curriculum Development Council (2017). *Key Learning Curriculum Guide (Primary 1 – Secondary 6) – Technology Education*. P.47-48.

¹² The Curriculum Development Council (2017). *Key Learning Curriculum Guide (Primary 1 – Secondary 6) – Technology Education*. P.7.

Taking note of the experience of the United Kingdom (switching Junior Secondary Curriculum from skills-based ‘Information and Communication’ to concepts-based ‘Computing’ in 2013), the Education Bureau should continue to maintain its regulation to “allocate at least 30% of the lesson time of the Information and Communication Technology (ICT) knowledge context at Junior Secondary Level to teach programming”.¹³ This would strengthen the role of ICT education in developing students’ problem-solving skills.

(d) Enabling students’ life-long learning in the field of ICT

Despite the rapid and continuing advance of technology, teaching students the very latest knowledge might not necessarily be the most effective approach. ICT knowledge and product lifecycles are becoming increasingly short-lived. What students learn at Junior Secondary Level might already be outdated by the time they complete their studies.

As stated by the interviewed experts, ICT education should be focused on enabling students’ life-long learning, so they are more interested, willing and able to adapt to new technology they encounter in the future. One of the interviewed experts even emphasized that education should be started as early as possible at Junior Secondary Level, not only at Senior Secondary Level as stated by the curriculum guide¹⁴.

2. A significant difference between teachers’ and students’ evaluation of ICT ability was observed, as teachers generally held higher expectations of students than the students themselves.

According to the results of the school survey, most of the teachers surveyed expected their students to be able to apply what they learn from Junior Secondary ICT education into their work. Yet, the results of the online student survey found that, no matter how difficult the asked-for ICT knowledge was, the majority of students claim to only being able to recognize the names of ICT tools or perform simple operation procedures.

¹³ Same as above. P.53.

¹⁴ Same as above. P.9.

The disparity between teachers' expectations and students' self-evaluation reveals there could be issues in the transfer of knowledge. In turn this will limit the effectiveness of ICT education at Junior Secondary Level.

3. Teachers reported facing challenges such as having insufficient lesson time and difficulty in reviewing the curriculum when implementing ICT education at Junior Secondary Level.

(a) Insufficient lesson time

At the moment, the Council requires each school to devote 8 to 15% of the total lesson time at Junior Secondary Level (around 220 to 413 hours) to Technology Education¹⁵. One of the interviewed experts questioned whether schools are able to keep up with the requirement. It was pointed out that ICT has to compete with other technology-related subjects leading to insufficient lesson time.

From the online student survey, we learnt that schools are offering on average, 1.96 periods of ICT lessons every week. Despite matching the Council's recommendation¹⁶, more than half of the teachers surveyed (50.5%) claimed that "not having enough lesson time" was their major teaching challenge.

(b) Difficulty in reviewing the curriculum

Due to the Council granting schools a high degree of flexibility in designing the curriculum, the burden of reviewing course content falls mostly on teachers. The school survey pointed out that nearly 90% of schools surveyed (87.4%) claimed "teachers' professional decision" to be the main determining factor in developing the curriculum.

However a considerable percentage of teachers in the school survey, claimed that "keeping up with ICT developments" (53.5%) or "having too broad a curriculum" (31.3%) are the major challenges.

¹⁵ The Curriculum Development Council (2017). *Key Learning Curriculum Guide (Primary 1 – Secondary 6) – Technology Education*. P.6.

¹⁶ Same as above. P.124.

This suggests the Government should consider supporting teachers in these aspects of curriculum design, in order to enhance the efficacy of ICT education.

- 4. The students surveyed were shown to be inactive towards studying ICT-related knowledge, leading to concerns about whether students can practise life-long learning.**

As technology keeps advancing every single day, it is unrealistic to rely on school education to teach students all of the ICT knowledge. Thus, enabling students to practise lifelong learning of ICT is essential.

Students in this survey were found to be inactive towards studying ICT. They preferred being taught through information-based lectures (mean score of 6.26, on a scale of 0 to 10, 0 being the lowest) than participation-based project or presentation work (mean score of 4.99). Also, most of the surveyed students disagreed with the statement “ICT is as important as the other subjects” (mean score of 4.72), differing significantly from teachers (mean score of 7.68).

Student apathy towards studying ICT, leads us to question whether they are able to acquire the necessary knowledge through self learning in the future.

- 5. Other than teachers, stakeholders (e.g. the business sector and parents) can also contribute to make ICT education at Junior Secondary Level better.**

Content covered by ICT education is extensive and constantly changing in accordance with the advancement of technology. Therefore, it is impossible to rely on teachers alone to provide all IT-related knowledge to students. The contribution from other stakeholders (such as the business sector and parents) is also essential.

One of the interviewed experts claimed that, by collaborating with the education sector, ICT companies are able to demonstrate Corporate Social Responsibility (CSR) while also using the education sector as a test-bed for their latest products.

The interviewed expert hoped that parents could be good examples to their children by actively learning more about ICT. He believed that this would strengthen the parent-child bond while encouraging students to learn more about IT (In turn benefiting both the parents and youth in the future ICT-savvy society).

Recommendations

Based on the above research findings and discussion points, we propose the following measures to improve the efficacy of ICT education at Junior Secondary Level:

1. Set a minimum lesson time requirement for ICT education at Junior Secondary Level.

The Curriculum Development Council should set a minimum requirement of “spending at least 5% of total lesson time in the ICT knowledge context (around 2 periods per week)” on top of the existing “at minimal 8% of lesson time for technology education requirement.” By doing so, it would not only relieve the pressure of teachers having insufficient lesson time but it would also strengthen the importance of ICT education to Junior Secondary students.

2. Making “Information Literacy” compulsory within the ICT curriculum at Junior Secondary Level.

With the vast array of information, it is important to equip students with the ability to verify the authenticity of online information and to use it in an ethical manner. To do so, the Council ought to make “Information Literacy” a compulsory part of the ICT curriculum, with at least 10% of lesson time dedicated to it during ICT lessons. As such, it will ensure each student has a basic level of understanding of information literacy after finishing Junior Secondary Level.

3. Continue to develop free teaching materials for teachers to help them catch up with new technology and allowing them to update their course content.

The Education Bureau has been providing free materials for teachers' use in recent years (e.g. Arduino, Micro:bit and Python¹⁷). It is suggested that the Bureau should continue this supportive work, and expand its range to include newer items, such as Artificial Intelligence (AI) and Augmented Reality (AR)). This would allow teachers to catch up with new technology and update their courses.

4. Encourage schools to use the \$1 million grant from the IT Innovation Lab in Secondary Schools Programme in creative ways, to enrich ICT education at Junior Secondary Level.

As revealed in the 2019-20 budget, each secondary school will be granted \$1 million under the IT Innovation Lab in Secondary Schools Programme. This can be used for procuring necessary ICT equipment and professional services, and organizing more relevant extra-curricular activities to deepen students' knowledge of cutting-edge ICT¹⁸. With this new grant, we recommend schools to take the opportunity to enrich their ICT educational programmes by:

(a) Organizing ICT-related extra-curricular activities as extensions to regular lessons.

Schools can provide extra-curricular activities to students who are at a higher level and/or more interested in ICT:

- 'Future skills workshops': Equip students with the latest technical knowledge and industry trends in Innovative Technology (like AI or AR) through case studies, workplace visits, and encouraging them to consider taking up ICT-related subjects for future studies.
- 'Enriched ICT classes': Provide extra learning opportunities for

¹⁷ Education Bureau. (2019). Computer Education – Learning and Teaching Resources. Retrieved June 4, 2019, from <https://www.edb.gov.hk/en/curriculum-development/kla/technology-edu/resources/computer-edu/resources.html>

¹⁸ The HKSAR Government (2019). *Budget 2019-20*. Paragraph 79.

students who are eager to learn high-level ICT knowledge (like programming and network building), smoothing the transition from junior-level to senior-level ICT studies.

(b) Introducing external partners to assist teachers in practising creative teaching methods for specific topics.

The key to success for ICT education is to be able to expand and deepen the connection between knowledge and daily application. For example, experiential learning is the best way to teach Information Literacy as it requires students to reflect themselves and apply the learnt principles. So we recommend that schools introduce external partners to assist teachers in practising creative teaching methods, when appropriate.