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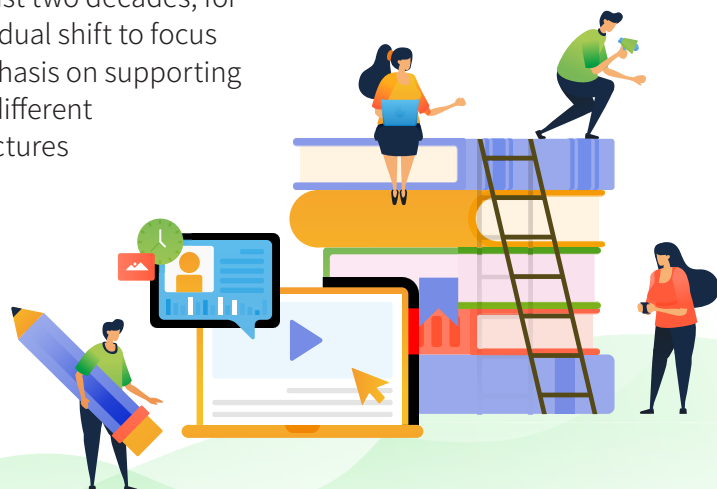
Online-learning preparedness for schools

Preparedness for quality online learning experiences and outcomes

Hong Kong launched its first IT in Education (ITE) Strategy in 1998, which thereby marking the first official policy in which Information and Communication Technology (ICT) is treated as an integral part of the whole curriculum to support learning and teaching, beyond simply a segregated school subject. The second ITE Strategy launched in 2003 formally highlighted a major role of ITE in achieving the overall curriculum reform goals announced the year before. In 2011, the Education Bureau (EDB) funded 21 e-learning pilot projects, many of which were joint ventures involving several schools, for the purpose of fostering e-learning good practices that promote student-centered, transformative learning. Thus, over the past two decades, for ICT use in education at the policy level, there has been a gradual shift to focus on e-learning, i.e. the use of digital technology with the emphasis on supporting student learning. During this time, schools have developed different digital infrastructure, curriculum priorities and support structures for e-learning. These prior developments and experiences for e-learning also laid the foundation for online learning during the COVID-19 pandemic which triggered school suspension. In this Study, we collect data about schools' e-learning policy and implementation to investigate the key features that constitute *preparedness* for quality *online learning* experiences and outcomes.

e-learning **team members**, **roles** and **functions**

Prioritizing **teacher professional learning** and **support**

Technology infrastructure & **pedagogy** for student empowerment

What matters for e-learning at school level

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Outcomes and challenges of online learning during school suspension

In the first bulletin of this research project series, we reported on the following three findings:

Effort of schools and parents to sustain learning paid off

Pre-suspension e-learning preparedness crucial to effective online learning transition

The cumulative negative effects due to socioeconomic and digital divides on disadvantaged students need attention

What are the most important e-learning implementation factors for Online Learning Preparedness?

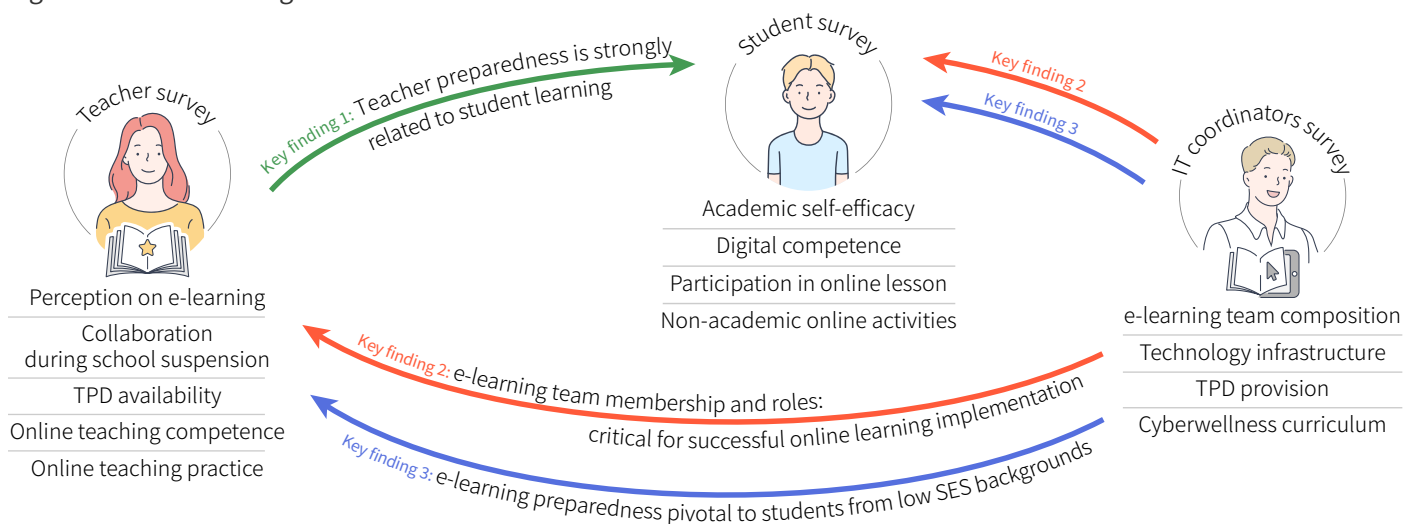In this second bulletin, we report on our investigation on the following questions at the school level:

1 How does teachers' preparedness for online learning correlate with their students' learning experiences and outcomes during the school suspension period?

2 What are the key features of a school's e-learning implementation that contribute most importantly to students' effective online learning?

3 Are there implementation factors that would mitigate the online learning divides for students from low SES backgrounds?

Research Design

Research studies on student learning, whether related to digital technology or not, emphasize the pedagogical and supportive roles played by teachers. To answer the first research question by the same token, we first compute indicators for teachers' e-learning preparedness before school suspension and their online teaching preparedness during school suspension based on the teacher survey responses. The overall school means for these teacher preparedness variables were then used as the predictors in a multilevel model to explore how these correlated with the students' reported experiences and perceptions based on the student survey responses from their own school.

Another important set of school level preparedness factors influencing students' online learning relates to how schools organize their own e-learning implementation. Thanks to the support of the IT Coordinators (ITC) from the participating schools who have provided detailed responses to the ITC survey, we were able to extract a number of IT implementation indicators for each responding school. Similar to the design for answering the

Figure 1. Research design for this bulletin

Teacher survey

Key finding 1: Teacher preparedness is strongly related to student learning

Student survey

Key finding 2

Key finding 3

IT coordinators survey

Perception on e-learning
Collaboration during school suspension
TPD availability
Online teaching competence
Online teaching practice

Academic self-efficacy
Digital competence
Participation in online lesson
Non-academic online activities

e-learning team composition
Technology infrastructure
TPD provision
Cyberwellness curriculum

Key finding 2: e-learning team membership and roles: critical for successful online learning implementation

Key finding 3: e-learning preparedness pivotal to students from low SES backgrounds

first research question, we conducted multilevel modeling to explore the relationship between school level implementation factors and students' online learning experiences and outcomes. In addition, we also investigate how these IT implementation factors influence teachers' preparedness for online teaching.

To answer question 3, we used the SES scores for each student (reported in Bulletin 1 and computed using a number of student background characteristics, with details in Table 7 in Finding 3 of this bulletin). Using this SES score, we categorized all responding students into three SES groups: high SES (top 30%), middle SES (next 40%), and low SES (lowest 30%). All multilevel models involving student variables were constructed separately for each of the three SES groups. While the reporting for the first two questions refers to the overall set of findings, in answering question 3, we examine the differences across the three SES groups of students, if any, and their implications.

How do Schools Implement e-Learning and Online Learning?

In this bulletin, we use the term *e-learning* in a broad sense to include digital technology use for classroom-based, blended and fully online modes of learning. In order to discharge all duties related to the implementation of e-learning, schools need to arrange for personnel to take responsibility. The quality and expediency in the fulfillment of these functions also depend on the expertise and decision-making capacities of the appointed personnel. Figure 2 is a diagrammatic representation of the three categories of functions necessary for smooth implementation of different modes of e-learning.

Figure 2. The categories of function needed for effective implementation of e-learning
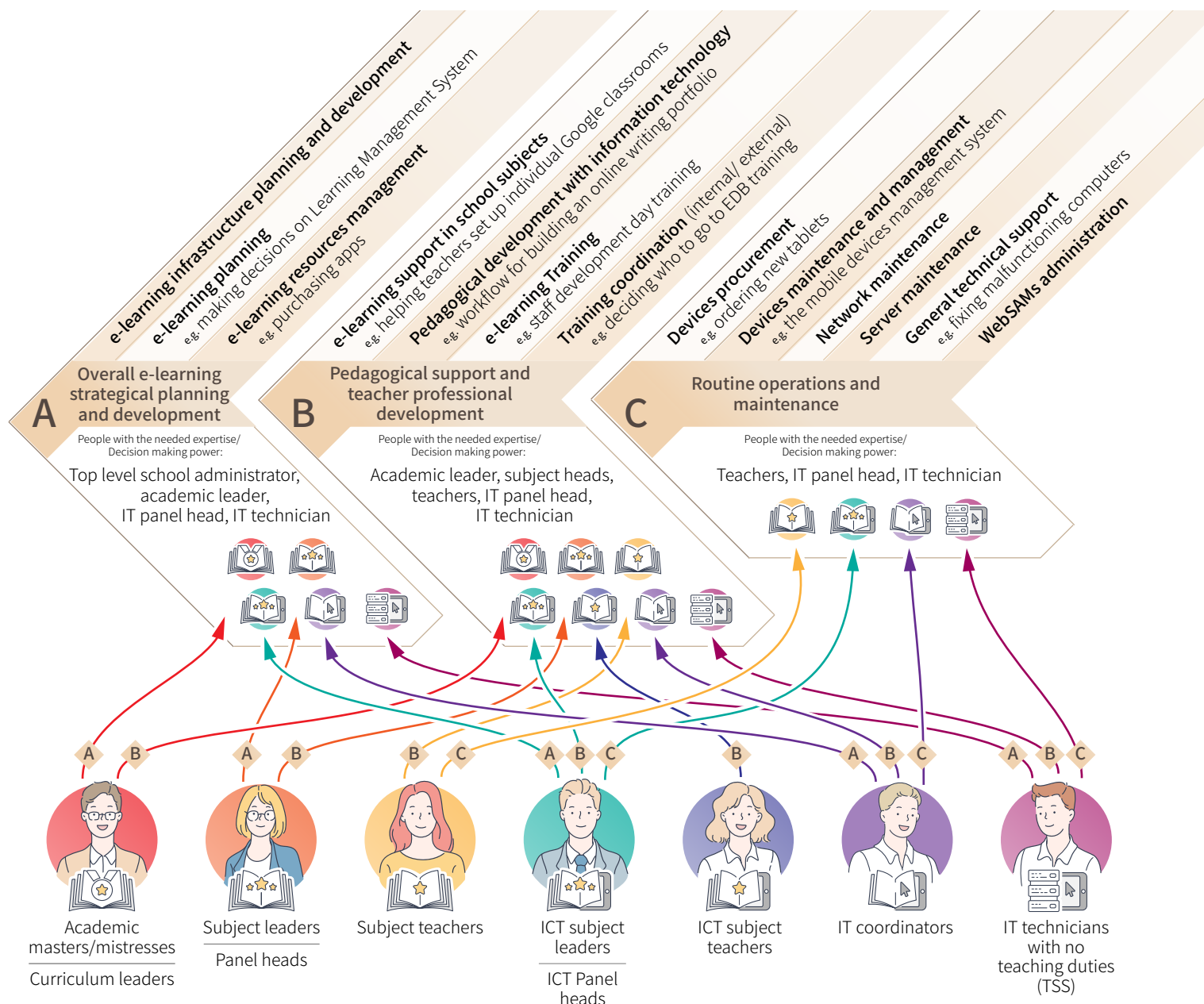
There is in general three categories of functions that needs to be taken care of for e-learning to be implemented smoothly in a school:

Category **A** functions are mainly related to overall school level strategic planning involving digital infrastructure and resources, with significant implications for the overall school development and budgetary implications. These, thus, need the involvement of top-level school leadership such as the school principal, vice principal, and the academic master/curriculum leader. It also requires knowledge of technology and e-learning pedagogy.

Category **B** functions pertain to curriculum, pedagogy and professional development, and need the involvement of personnel within the school who have such expertise, such as the academic leader and panel heads of different subjects. Since the target beneficiary of these pedagogical support and development are primarily teachers less experienced in e-learning, there needs to be ways for their voices to be reflected in the decision-making process.

Category **C** functions are associated with routine operations and maintenance, and thus should preferably include personnel whose expertise and responsibilities are primarily that of technical support, such as an IT technician (often taking on the position of TSS in schools). The target beneficiaries of these services are teachers and students. Decisions on what and how these functions need to be performed should be made in consultation with those who have a good understanding of what is needed to support the e-learning implementation priorities in the school as well as the background and expertise of students and teachers overall.

All surveyed schools reported having at least two persons taking responsibility for IT and e-learning implementation functions in the school. In this sense, all participating schools had an IT Coordination/e-learning team. In fact, some schools have more than one team taking on different aspects of these responsibilities and may use different names to refer to these teams. The ITC survey asked about who were involved in the different functions in the school rather than about membership in a specific team to avoid confusion. The survey asked which of the following types of school personnel were involved in handling each of the 16 implementation functions: the ICT coordinator, IT technicians, ICT subject teachers/heads, other subject teachers, head of academic affairs, outsourced external support, or others not listed. For simplicity, we use the term "ITC team" as a shorthand to refer to the totality of school personnel involved in the provision of any of these functions in this bulletin.

Teachers' preparedness for online teaching is positively correlated with students' online learning experience and outcomes

Teachers' knowledge, skills and attitudes related to technology use for teaching and learning impacts directly on how willing they are to adopt e-learning and online learning before and during school suspension. It is thus expected that some important aspects of teachers' online teaching practices and preparedness will affect their students' online learning experiences and outcomes before and during the school suspension period. Before we report on our findings regarding this relationship, we report on some important indicators of student learning experiences and outcomes during the school suspension period from the student survey data.

1. Students' learning experiences and outcomes during school suspension

We collected information from students regarding their online participation in academic and non-academic activities, the extent to which they had improved in their digital skills, the extent to which they had learnt new digital skills, and their academic self-efficacy. The means and standard deviations of these variables are summarized in Table 1.

Table 1. Students' learning experiences and outcomes during school suspension

Students' learning experiences and outcomes *during school suspension*		Secondary students Mean (SD)	Primary students Mean (SD)
Digital activities (frequency of participation)[1]	Online learning activities	3.12 (1.33)	3.12 (1.48)
	Digital socialization and entertainment activities	3.67 (1.40)	2.93 (1.54)
Learning outcomes (extent of agreement)[2]	Improving digital skills	3.39 (0.93)	3.70 (1.06)
	Developing new digital skills	2.91 (1.22)	3.29 (1.35)
	Having academic self-efficacy	3.15 (1.05)	3.61 (1.09)

[1] Frequency of participation   1 Not at all   2 Once a week   3 2-3 times a week   4 4-5 times a week   5 >5 times a week

[2] Extent of agreement   1 Strongly disagree   2 Disagree   3 Neither agree nor disagree   4 Agree   5 Strongly agree

The student survey asked about the frequencies of participation in nine different types of online learning activities. Results in Table 1 shows that both primary and secondary students reported similar mean levels of participation, which is around 2-3 times a week on average for the different activities. Both primary and secondary students agreed that their digital skills improved during the school suspension period, but primary students reported a higher level of agreement. When asked about whether they had learnt new digital skills, students from both levels reported moderate levels of gains, but secondary students reported a higher level of gain. On average, primary students reported positive responses towards a range of statements that indicate academic self-efficacy, whereas secondary students tended to be more ambivalent. Students were also asked about the frequencies with which they used digital devices each day for chatting with friends, browsing or posting on social media or for entertainment. We note that both primary and secondary students report similar frequencies in their participation in online learning activities, but secondary students had significantly higher levels of participation in using digital technology for socialization and entertainment.

2. Teachers' preparedness for blended and fully online learning and teaching

Technology-mediated teaching and learning, whether it be using digital technology for face-to-face classroom teaching, for students' self-directed learning in blended learning mode, or for fully online learning and teaching, poses challenges to teachers. Teachers need to learn not only new technical skills, but also new pedagogies, and new ways of organizing learning and assessment. Teachers need pedagogical and technical support from the school to translate their learning into actual pedagogical practices . A collegial school culture also gives teachers the courage to try new ways of doing things, which inevitably involve taking risks. It is also important to note that it is more challenging for teachers to use digital technology to support student-centered pedagogies such as student peer collaboration, inquiry and productive problem-solving activities, which are critical for the development of 21st century skills.

Table 2 summarizes the key indicators of teachers' preparedness for online teaching during the school suspension period.

Table 2.   Teachers' online teaching preparedness indicators during school suspension

Teachers' online teaching preparedness indicators *during school suspension*	Secondary teachers Mean[1] (SD)	Primary teachers Mean[1] (SD)
Extent of use of different e-learning tools	3.09 (0.85)	3.07 (0.89)
Perceived effectiveness of different online teaching methods	3.02 (0.60)	3.16 (0.56)
Extent of teacher collaboration for online L&T	2.90 (0.79)	3.22 (0.71)
Availability of pedagogical support for online L&T	2.82 (0.82)	3.01 (0.79)
Availability of general technical support for online L&T	2.66 (0.89)	2.85 (0.86)

[1] Level of preparedness | 1 Not at all | 2 To a small extent | 3 To a moderate extent | 4 To a large extent

Table 2 indicates that the perceptions and experiences reported by primary and secondary teachers are very similar. Teachers were asked about their extent of use for nine types of e-learning tools, and the results show that on average teachers have a moderate level of use for these tools. In terms of the perceived effectiveness of four types of online pedagogies, the overall rating was generally effective. Teachers also reported moderate levels of collaboration with their school colleagues in various online teaching related matters, and primary teachers reported a higher mean level of collaboration. In terms of the availability of pedagogical and general technical support for online teaching and learning, the levels of reported availability were similar across the two types of support and similar across primary and secondary schools, which were only moderate.

The teachers' experiences and perceptions about online teaching and learning reflect how prepared they were for online teaching and learning during the school suspension period and we refer to these characteristics as teachers' online teaching preparedness.

3. Teachers' preparedness at the school level has a strong influence on students' learning experiences and outcomes
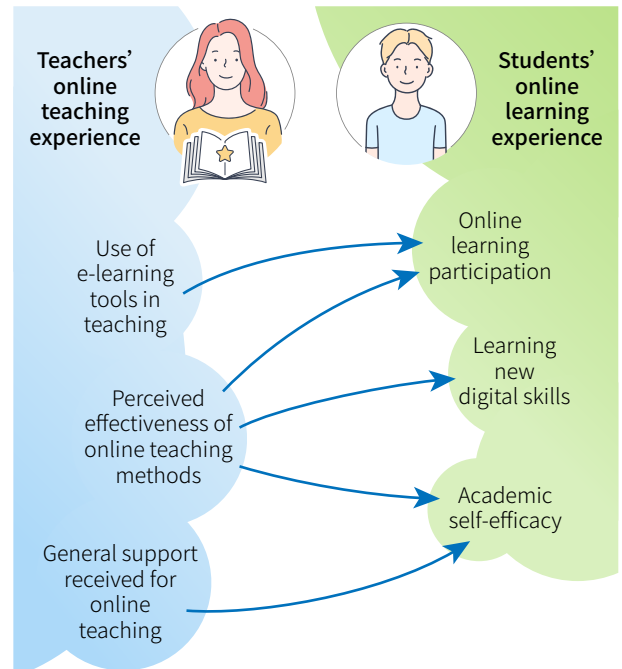
While we collected survey data from teachers and students from the same schools, we did not collect information whether a particular teacher teaches specific classes of students. Hence, we are not able to connect each responding teacher with the specific student respondents from their own school to identify the relationship between teacher preparedness and student experiences and outcomes. Instead, we computed the mean scores of teacher preparedness for each school and used these as the school-level predictor variables in multilevel modeling analyses. The results show that only three of the teacher preparedness indicators and three of the student experiences and outcomes showed statistically significant correlations. The relationships are represented in Figure 3.

As shown in Figure 3, the extent to which teachers perceive the effectiveness of various online teaching methods has the most pervasive impact on students, contributing positively to students' reported online participation, the extent to which they have learnt new digital skills and their reported academic self-efficacy. The online methods listed in the survey included: using videos made by teachers for student learning, using high quality learning materials sourced online, whole class teaching through videoconferencing, group or individual consultation with students through videoconferencing, student discussions online through group chat or discussion forums. Thus, a higher average level of perceived effectiveness indicates that the teacher had used a diverse set of online pedagogies and were able to achieve the intended outcomes for those activities.

Another significant teacher preparedness indicator was the teachers' extent of use of different e-learning tools. Higher reported use predicts greater participation of students in online learning activities. When teachers are able to use a variety of different e-learning tools instead of only a few, they are more able to provide different online learning experiences for students.

Figure 3. Correlations between teacher preparedness and student experiences and outcomes

A third significant teacher preparedness indicator was the availability of general technical support for online learning and teaching in the school as reported by teachers. When more support was available to teachers, the students reported higher levels of academic self-efficacy. This particular aspect of preparedness relates directly to school level preparedness for online teaching and learning, which is addressed in the next finding.

What matters in school-level e-learning implementation?

## Team membership and roles, infrastructure priorities and teacher professional development provisions

The ITC survey results show that:

1. Very few schools outsourced any of the 16 implementation functions listed in Figure 2 to outside agents;

2. There was a huge diversity in terms of the total number of school personnel, and the number of different staff roles involved in the ITC team across schools.

3. There was also a huge diversity in terms of the availability of different functions and how these were organized in schools.

The diversity in terms of team composition and roles, as well as in the kinds of implementation features found in the participating schools provide the study with rich data to explore which implementation features contribute most to a school's preparedness for online teaching and learning.

Using multilevel modeling, we found that four aspects of a school's e-learning implementation had significant effects on teachers' online teaching experiences and practices during the school suspension period: the ITC team composition, technology infrastructure, teacher professional learning provisions and the types of curriculum integration provisions made to achieve the cyberwellness related learning outcomes. Figure 4 shows the significant relationships from the modeling. It is clear from the figure that four aspects of a school's e-learning implementation have significant influence on students' and teachers' online learning and teaching experience during the school suspension period, three of which connect with the three categories of the ITC team's

Figure 4. Correlations between school level IT implementation and e-learning experience of teachers and students
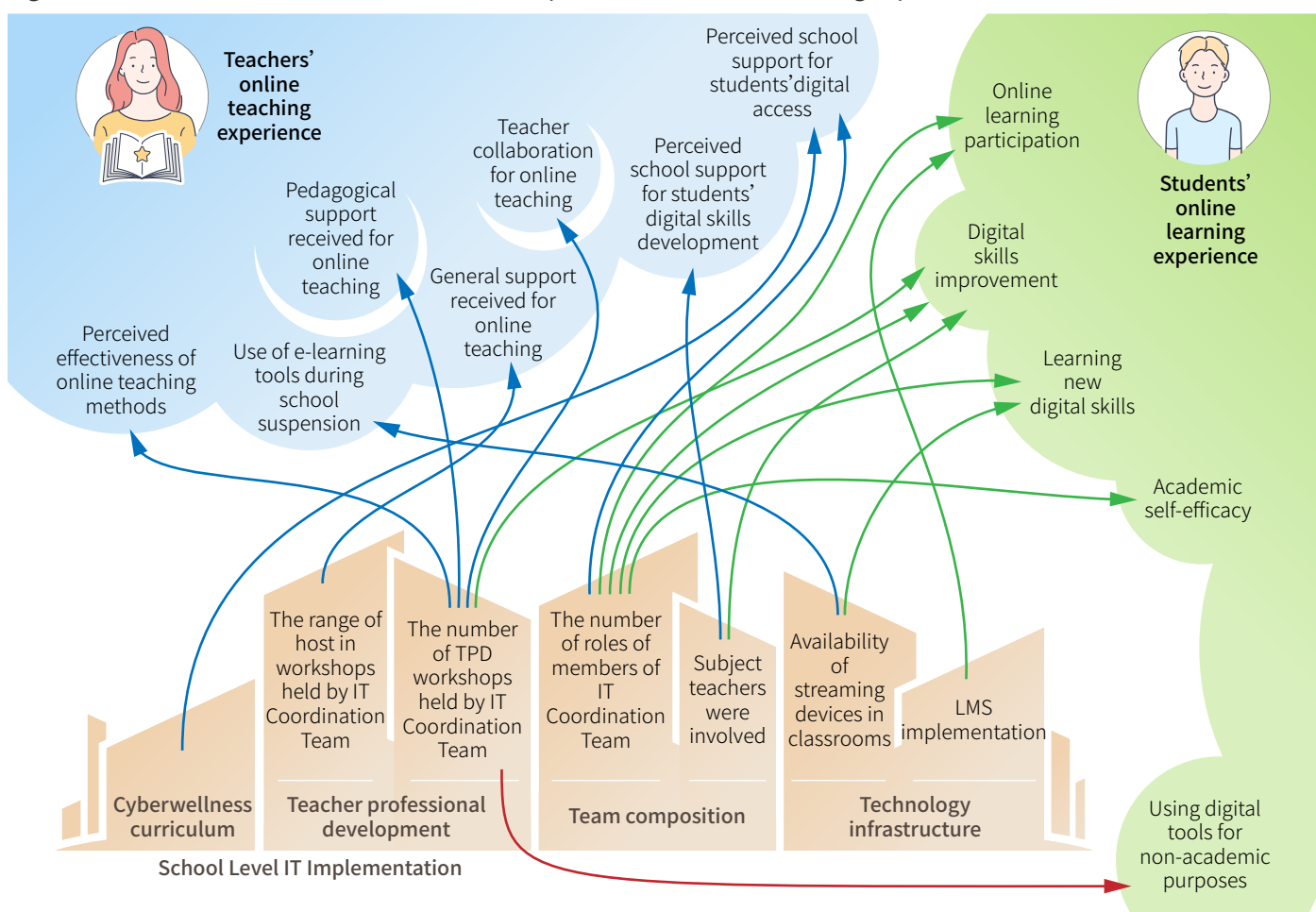
functions, while the fourth relates to arrangements regarding the cyberwellness related curriculum in the school. Further, Figure 4 also shows that the two most influential aspects on both teachers' and students' experiences are the ITC team composition and the arrangements in place throughout the 2019-2020 school year for teacher professional development.

ITC Team Composition

In terms of the team composition, the more staff role types that members of the ITC team are involved in, the greater the positive impact, particularly in terms of the students' reported online learning experiences. Students reported greater levels of participation in online learning activities, greater digital skills improvement, more likely to have learnt new digital skills and greater academic efficacy. On the teachers' side, the greater number of role types was associated with a stronger perception that the school has made special provisions for students' digital access during the school suspension. Thus, it appears that having more roles involved in the ITC team helps the school to develop practices and support systems that can cater for the online learning needs of students.
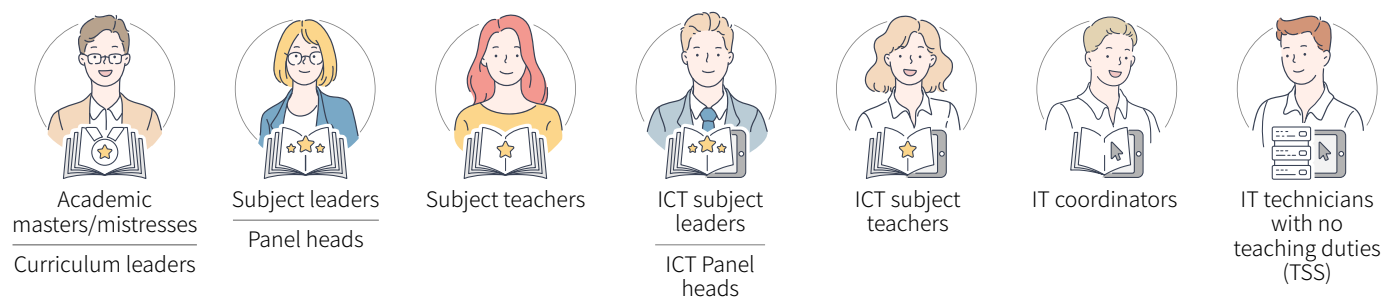
Table 3. No. of members in IT coordination team of participating schools

IT coordination team composition						
No. of members in team	0-2	3-5	6-8	9-12	13-20	>20
No. of surveyed schools	1	6	11	19	8	4

Table 4. Personnel types in IT coordination team of participating schools

Personnel types team composition						
No. of personnel types	1	2	3	4	5	6
No. of surveyed schools	1	2	7	11	14	14

Figure 5. Staff roles types in ITC team

Academic masters/mistresses — Curriculum leaders | Subject leaders — Panel heads | Subject teachers | ICT subject leaders — ICT Panel heads | ICT subject teachers | IT coordinators | IT technicians with no teaching duties (TSS)
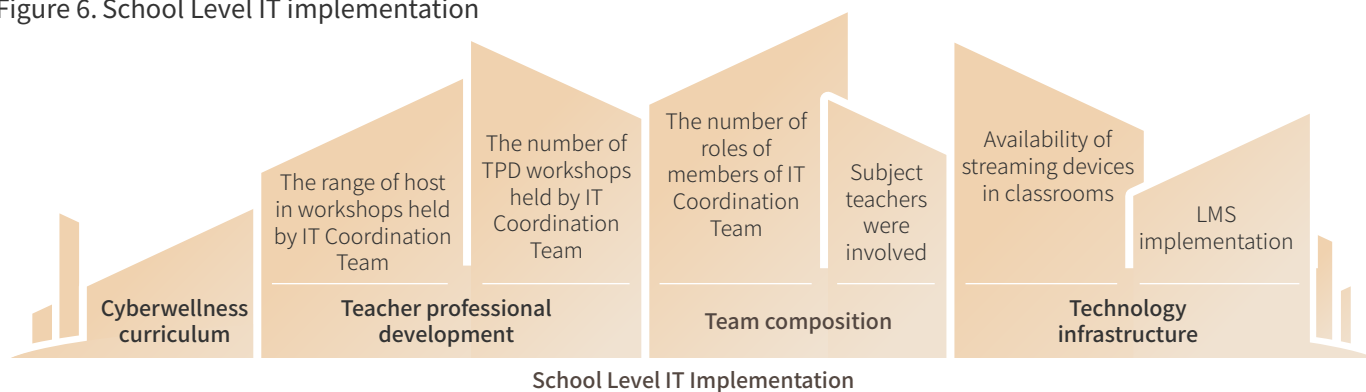
Another aspect of team composition that had a significant effect was whether other subject teachers were involved in routine operations and maintenance. For schools where other subject teachers were involved, their students reported significantly greater digital skills improvement, and their teachers perceived significantly greater school support for student digital access. This is probably because the digital literacy skills and support required for learning in different subjects may be different and the involvement of subject teachers will help schools to develop support services that can cater for more diverse online teaching and learning needs.

Functions of the ITC team

Figure 6. School Level IT implementation

The range of host in workshops held by IT Coordination Team

The number of TPD workshops held by IT Coordination Team

The number of roles of members of IT Coordination Team

Subject teachers were involved

Availability of streaming devices in classrooms

LMS implementation

Cyberwellness curriculum

Teacher professional development

Team composition

Technology infrastructure

School Level IT Implementation

Teacher Professional Development (TPD) Provisions

It is not surprising that schools' TPD provisions had the most pervasive impacts on teachers' online teaching experiences. The TPD indicator with the most extensive significant positive predictions on teachers' experiences was the number of e-learning-related TPD activities organized by the school during the 2019-20 school year. The higher number of eLearning TPD activities reported in the ITC survey was found to be negatively correlated with students' reported use of digital technology for non-academic purposes, that is, for socialization and entertainment. This negative relationship may indicate that better prepared teachers were providing more engaging online learning activities and tasks that took up more of their attention and time.

Table 5.   e-learning TPD activities of participating schools in 2019-20

No. of e-learning TPD organized in 2019-20					
TPD events organized	0	1-2	3-4	5-7	>7 [1]
No. of surveyed schools	3	17	10	16	3

[1] One of the surveyed schools organized 14 TPD events

ICT Infrastructure for Teaching and Learning

Schools differ widely in the many aspects of ICT infrastructure in the school, including the ratio of digital devices (computers and tablets) per total headcount of staff and students, the number of projectors and interactive white boards per classroom and the perceived adequacy of wifi connectivity of the school. However, only two infrastructure-related indicators turned out to have significant correlation with students' and teachers' experiences during the school suspension period. One of these was the percentage of classrooms equipped with streaming devices, such as Apple TV. A higher percentage was positively correlated with students reporting having learnt new digital skills, and teachers reporting use of e-learning tools in online teaching. One important difference between streaming devices in the classroom and most of the other infrastructure indicators is that these devices are necessary only if the students were required to share their work on their tablets with the whole class during lessons. Thus, this infrastructure has an important pedagogical meaning—that the school values digital technology as an empowering tool for student interaction and collaboration, an important feature of student-centered pedagogy.

Another significant ICT infrastructure indicator was the importance of the school's Learning Management System (LMS) for different stakeholders: teachers, students, school administrators, and parents. The higher the importance reported in the ITC survey, the higher the level of online learning participation reported by students.

Cyberwellness in the School Curriculum

The ITC survey reported on whether and how the school incorporated teaching related to digital competence, anti-cyberbullying and data security in the curriculum. For each of these three aspects of cyberwellness, the responses could be: (1) this was not part of the curriculum, (2) this was taught within a specific subject (such as computer literacy), (3) this was integrated into other subjects, or (4) integrated into other curricular activities such as moral and civic education, extracurricular activities, or life-wide learning activities. The survey respondent can choose all applicable responses. Since we did not actually assess students' competence in these three cyberwellness aspects, we do not know the actual impact of these curricular arrangements on student learning. However, the analysis shows that the different number of ways of incorporating cyberwellness learning opportunities for students was positively correlated with a higher level of perceived school support for students' digital access by teachers. We interpret this correlation not as a causal outcome, but reflecting the fact that schools paying more attention to the teaching and learning of cyberwellness are also more sensitive to catering for students' needs in online learning participation.

In analyzing the impact of school level eLearning implementation on students, we have taken account of the significant role of students' socioeconomic status (SES) on students' learning experiences and outcomes. Thus, the findings related to students' experiences reported in this section is a general overall picture. How such relationships differ across student SES backgrounds is reported in the next section.

Table 6. Efforts to incorporate cyberwellness into school curriculum

Issues in cyberwellness	Digital competence	Anti-cyberbullying	Data Security
Not part of curriculum	2 schools	1 schools	1 schools
One way of curriculum incorporation	26 schools	13 schools	2 schools
Two ways of curriculum incorporation	15 schools	17 schools	10 schools
Three ways of curriculum incorporation	6 schools	11 schools	14 schools

* Ways of curriculum incorporation:
  Taught within a specific subject (e.g. computer literacy)   *and/or*
  Integrated into other subjects   *and/or*
  Integrated into other curricular activities (e.g. Moral and civic education, extracurricular activities, or life-wide learning activities)

School and teacher preparedness for online learning plays a pivotal role in online learning experiences and outcomes for students from **low SES backgrounds**

In Bulletin 1, we reported on the cumulative negative effects due to socioeconomic and digital divides, and that disadvantaged students need attention. Specifically, we reported on the higher levels of stress reported by low SES students in all surveyed sources of worries compared to students from high SES backgrounds. In this bulletin, we further explore issues of SES divide during school suspension with regard to their learning experiences and outcomes. Table 7 summarizes the means and standard deviations for four self-reported learning outcomes collected through the student survey. There are several important observations based on these results:

1. The low SES students have the lowest means in all four areas of self-reported learning outcomes: extents of digital skills improvement, learning about new digital skills, as well as academic self-efficacy before and during school suspension, whereas students in the high SES group scored the highest in all four areas.

2. Comparing students' academic self-efficacy before and during the school suspension period, both the middle and high SES students reported an increase during school suspension, whereas the low SES students reported a decrease.

Table 7. Students' self-reported learning outcomes and academic self-efficacy

Students' self-reported learning outcomes		Low SES[1] Mean (SD)[2]	Middle SES[1] Mean (SD)[2]	High SES[1] Mean (SD)[2]
During schools suspension	**Digital skills improvement**	-0.18 (1.03)	0.00 (1.01)	0.18 (0.93)
	Learning new digital skills	-0.15 (0.99)	0.05 (1.00)	0.08 (0.99)
	Academic self-efficacy	-0.21 (1.06)	0.02 (0.99)	0.18 (0.92)
Before school suspension	**Academic self-efficacy**	-0.15 (1.09)	0.00 (0.97)	0.15 (0.93)

[1] SES score is computed using the following indicators: have a desk to study, own personal room, have a quiet place to study at home, the number of books at home, and the highest level of education completed by parents. Students with SES scores within the top 30% of the total sample is categorized at high SES students, those scoring in the bottom 30% are categorized as low SES students, and the remaining 40% is categorized as middle SES.

[2] These outcome scores have been standardized to have a mean of 0 and a standard deviation of 1.

These results show that low SES students were academically disadvantaged and there is evidence that such disadvantage increased due to school suspension.

In the Key finding 1 section in this bulletin, we reported on our findings that both teacher and school level preparedness contributed positively to students' online learning experiences and outcomes. in this section, we further explore whether school and teacher preparedness had differential impact on students from different SES background in relation to their online learning experiences and outcomes during the school suspension period. Whereas in Key finding 1 we reported on the influence of teachers' online teaching preparedness on students' online learning overall, Table 8 presents the results of the multilevel modeling conducted separately for each of the three SES groups.

The results in Table 8 shows that in all three SES groups, increases in teachers' extent of use of different e-learning tools correlate similarly to increases in students' reported participation in online learning activities. However, correlations for the other two areas of learning outcomes are different across the three SES groups. There was no significant correlation between any of the teachers' preparedness indicators with the reported learning of new digital skills or academic self-efficacy for the high SES students. For the low SES students, their teachers' perceived effectiveness of online teaching methods correlated positively with the extent to which they were able to learn new digital skills and their academic self-efficacy. For the middle SES students, none of the teacher preparedness indicators predicted a statistically significant extent of learning new digital skills, but higher levels of teacher preparedness predicted greater increases in academic self-efficacy.

In Key finding 2 in this bulletin, we reported on how school level e-learning implementation through its ITC team and contributed positively to students' learning experience at the student population level. Table 9 presents the same multilevel analysis results, but conducted separately for each SES group of students.

Table 8. Multilevel modeling results for teacher preparedness indicators predicting student experiences and outcomes

Teacher preparedness for online teaching	Student online learning experiences and outcomes *during school suspension* Regression coefficient (p-values)[1]		
	Participation in online learning activities	Learning new digital skills	Academic self-efficacy
Availability of general technical support for online L&T			0.28 (p=0.01)
Teachers' extent of use of different e-learning tools	0.46 (p=0.07) 0.4 (p=0.02) 0.37 (p=0.04)		
Teachers' perceived effectiveness of online teaching methods	-0.35 (p=0.07)	0.4 (p=0.07)	0.28 (p=0.01) 0.39 (p=0.05)

[1] Regression coefficient and p-values shown only for statistically significant results at the .10 level.

Low SES students | Middle SES students | High SES students

Similar to the case of teachers' influence on student learning, the influence of school level e-learning preparedness through its ITC team on the online learning outcomes of the high SES group of students was relatively limited: only on an increased level of participation in online learning activities and a decrease in use of digital devices for socialization and entertainment. On the other hand, both low and middle SES students reported higher gains in digital skills improvement and learning of new digital skills with higher levels of school e-learning preparedness. The middle SES students also increased in their academic self-efficacy with higher school levels preparedness.

Why is it that high SES students reported higher levels of digital skills improvement, new digital skills learnt and higher academic self-efficacy, but apparently not benefitting much from school and teacher level preparedness? The opposite is observed for low SES students: lower digital skills and academic gains compared to high SES students but having clear benefits from higher levels of teacher and school level e-learning preparedness. A reasonable interpretation is that because of their family background, high SES students had more sources of learning input and support beyond what is provided in their own schools. Thus, what schools can provide for low SES students is exceedingly important for low SES students.

Table 9. Multilevel modeling results for School e-learning implementation preparedness indicators predicting student experiences and outcomes

School e-learning implementation preparedness	Student online learning experiences and outcomes *during school suspension* Regression coefficient (p-values)[1]				
	Participation in online learning activities	Digital skills improvement	Learning new digital skills	Academic self-efficacy	Use of digital devices for socialization and entertainment
Non-IT subject teachers involved in routine operation decisions		-0.22 (p=0.08)			
Diversity of team members' role	0.14 (p=0.06)	0.12 (p=0.01)	0.10 (p=0.02) 0.09 (p=0.07)	0.07 (p=0.04)	
Availability of streaming devices			0.22 (p=0.06)		
Importance of the LMS to different stakeholders	0.33 (p=0.03)				
Provision of e-learning TPD activities		0.09 (p=0.04)			-0.10 (p=0.08)

[1] Regression coefficient and p-values shown only for statistically significant results at the .10 level.

Low SES students | Middle SES students | High SES students

Recommendations

1 Build a composite, robust e-learning team for student-centered decision making and action alignment

Establish a strong school-based team for e-learning implementation that comprises not only teachers with expertise in ICT and IT technicians, but also personnel with decision-making capacities such as the academic master/curriculum leader, as well as teachers of non-IT subjects in order to develop and implement an all-round strategic plan for fully online and blended modes of learning and teaching. With a large number of team members from diverse backgrounds involved in the e-learning coordination, schools also need to develop mechanisms to ensure tight coupling and alignment among members. This can be one important theme for interschool experience sharing for online learning preparedness.

2 Strengthen Learning Management System for all stakeholders

In planning the digital infrastructure of the school, give priority considerations to technology configurations, both on-site and online, that supports student-centered pedagogies, as well as peer interactions and collaboration among students. The role and functions of the school's Learning Management System should be strengthened to serve students, teachers, parents and school administrators in supporting student learning, peer interactions, assessment and feedback, rather than simply as a learning resources repository.

3 Provide more teaching and assessment related teacher professional development

School-based teacher professional development (TPD) opportunities are important for fostering teacher preparedness. These TPD activities need to be practice-oriented, i.e., closely connected with blended and online modes of teaching and learning within the school curriculum. Such activities should also foster teacher collaboration and community building.

Summary:

Implications of e-learning planning & implementation on students' online learning outcomes

1. Teachers' preparedness for online teaching is positively correlated with students' online learning experience and outcomes.

2. A school's e-learning team composition and functions, how it organizes e-learning related teacher professional development, and the involvement of non-IT subject teachers in the planning of routine support have major impacts on teachers' online teaching preparedness, and students' experiences and outcomes of online learning.

3. All of the positive contributing preparedness factors had more prominent beneficial effects on low SES students' online learning outcomes during the school suspension.

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🌐 https://www.ecitizen.hk/360/
✉ dcitizen@hku.hk

Research Team

Advisor
Prof. Catherine KK CHAN

Project Coordinator and Principal Investigator
Prof. Nancy LAW

Co-Principal Investigator
Dr. TAN Cheng Yong

Co-Investigator
Dr. LAN Min
Dr. PAN Qianqian

In conjunction with research assistants in the *Learning and Assessment for Digital Citizenship Project*

Supporting Organizations

AiTLE | BGCA 香港小童群益會 | Cyberport 數碼港 | Academy | HKACE 香港電腦教育學會 | 香港輔導教師協會 Hong Kong Association of Careers Masters And Guidance Masters Limited | AHS Hong Kong Association of the Heads of Secondary Schools | 香港教育城 HKedCity | 香港遊樂場協會 HONG KONG PLAYGROUND ASSOCIATION | Hong Kong Subsidised Secondary Schools Council 香港津貼中學議會 | HKAHSSHM HEADMASTERS AND HEADMISTRESSES