Student engagement in K-12 online learning amid COVID-19: A qualitative approach from a self-determination theory perspective

Abstract

During the pandemic, school and university students had to urgently move away from traditional classrooms to online learning in their homes. Student engagement that can be explained by self-determination theory (SDT) is important in online learning. Indeed, the founders of SDT recently stated that SDT-based future research should look closely at how to satisfy the basic needs in the theory in technology enhanced learning environments. We also know very little about K-12 student engagement in online learning. Therefore, this qualitative study used the SDT as a framework to understand K-12 school student engagement and disengagement in online learning. It used a thematic analysis to analyse interview data from 36 students and 18 teachers. The findings highlight that (i) online learning environments that supported more autonomy were more likely to engage students cognitively in developing two important lifelong skills of digital literacy and self-regulated learning; and (ii) those environments that lacked emotional attachment, equipment and resources, coupled with perceived digital incompetence and ineffective learning experience of the students suppressed cognitive and emotional engagement. Hence, this study suggests how to satisfy the need for competence and relatedness to prepare and implement online learning.

Keyword: self-determination theory, student engagement, online learning, K-12 education, COVID-19 pandemic

Most governments around the world have temporarily closed educational institutions in an attempt to contain the spread of the COVID-19 pandemic. These school closures are having a huge impact on education and will probably change the future of learning. School and university students have switched from traditional classrooms to emergency distance learning in their homes. The home and school contexts and environments are very different from each other, which dramatically changes how students engage and learn (Chiu & Hew, 2018; Xie et al., 2019). This has highlighted the importance of using technology in distance or home learning, referred to as *online learning* in this paper. Most previous studies of *online learning* were conducted in higher education (e.g., Bedenlier et al., 2020; Hsu et al., 2019; Sherer & Shea, 2011). Hence, student engagement in *online learning* is poorly established in K-12 schools, which has fuelled much attention among researchers and educators.

Student engagement is considered an important aspect of education because it is a necessary prerequisite for learning. The notion of student engagement – comprising behavioural, cognitive and emotional dimensions – can be explained using the construct of motivation (Losier et al., 2001). Motivation is the force that energises students to be engaged in a particular activity (Chiu et al., 2020). Self-determination theory (SDT) is a popular theory of human motivation, and posits that all individuals possess fundamental psychological needs for autonomy, relatedness and competence that move them to act or not to act (Ryan & Deci, 2017, 2020). Learning environments that satisfy the three needs are more likely to are able to move student motivational orientation from amotivation to extrinsic motivation to intrinsic motivation. This intrinsic motivation acts as an energy resource that encourages students to engage in learning (Reeve, 2013). Accordingly, the three need satisfactions have relations with the behavioural, cognitive and emotional engagement.

SDT has been widely applied to optimize student learning in the face-to-face settings (Ryan & Deci, 2017, 2020), but not in technology enhanced learning research (Hsu et al., 2019). This is echoed by the recent study of Ryan and Deci (2020), the SDT founders. They have suggested that future SDT studies should investigate how the three basic need be supported by technologies for greater student engagement such as e-learning and remote learning. Accordingly, useful guidance for satisfying the three needs in the design and implementation of online learning in school settings is unavailable. It is important to conduct and disseminate research in this area so that the future of learning can be developed locally and globally. Accordingly, this study took the opportunity of school closures to understand how to engage school students in online learning from a SDT perspective.

Theoretical background

Motivation theory and online learning

Multiple theories of motivation have been developed to account for human behaviour, including social cognitive theory (Bandura, 1994; Zimmerman, 2000), expectancy-value theory (Eccles, 2005), and SDT (Deci & Ryan, 2017, 2020). The first two theories emphasize on individual's efficacy to learn and achieve their goals as the factors influencing their choices and efforts. They were used to understand how students learning online. For example, Sansone and colleagues (2011) used goals-defined motivation (i.e., value and expectancy of learning), to develop Self-regulation of Motivation (SRM) model and suggested how to motivate students learn online. They suggest that directing initial choice of tasks and actions is essential in online learning. However, SDT focuses on intrinsic motivation directed towards the satisfaction of one's interests or desire for mastery. For the long-term development of students, developing intrinsic motivation

is arguably the most important factor in student learning, particularly in K-12 schools. Young children may not have clear expectancy and value of their learning. The next section discusses how need satisfactions in SDT affect student engagement.

Student engagement and Self-determination theory (SDT)

Student engagement refers to student active involvement in educationally effective practices and their commitment to educational goals and learning (Christenson, Reschly, & Wylie, 2012; Reeve, 2013). Engaged students find learning fun and meaningful, and invest energy and effort in their learning. Student engagement that drives learning is a multidimensional construct (Reeve, 2013) comprises three dimensions: behavioural engagement, cognitive engagement and emotional engagement (Reeve, 2013). Behavioural engagement refers to involvement in educational activities in terms of participation, effort, intensity or persistence; cognitive engagement defined as the extent to which students are willing and able to take on the learning task at hand; emotional engagement refers to the feelings students have towards teachers, peers, learning activities and school experience, as well as their sense of belonging (Fredricks, 2011; Sinatra et al., 2015). The three dimensions of engagement correspond to the learning processes of acting, thinking and feeling, respectively (Wang & Eccles, 2013). Although these dimensions are not completely independent of one another, they can be operationalised and conceptualised as distinct (Sinatra et al., 2015; Reeve & Tseng, 2011). Motivation is seen as a prerequisite of student engagement in learning (Reeve, 2013), which can be explained by SDT (Ryan & Deci, 2017; Losier et al., 2001).

The SDT of motivation suggests that all individuals possess three fundamental psychological needs that move them to act or not to act – the needs for autonomy, relatedness

and competence (Ryan & Deci, 2017). Autonomy refers to the need for freedom or choice over one's actions. The psychological need for autonomy provides a motivational basis for student behavioural engagement in a lesson (Skinner et al., 2008). Students with strong autonomy support are also likely to enjoy their lessons (i.e., have a higher level of emotional engagement) (Skinner et al., 2008). Autonomy is also assumed to lead to greater cognitive engagement; however, this assumption has not been extensively tested in educational technology (Bedenlier et al., 2020).

Competence refers to mastery of pursuits or learning (Ryan & Deci, 2017); it may thus be considered a critical motivating factor for student cognitive engagement (Skinner et al., 2008). Competence may also provide a motivational basis for behavioral and emotional engagement because it is reasonable to assume that a sense of mastery about the topic being studied would encourage encourage a learner to further participate in the topic activities, as well as foster positive learner feelings about the topic.

Relatedness refers to the sense or feeling of being connected to other people (Ryan & Deci, 2017). Several studies have demonstrated that student sense of relatedness can predict their behavioural and emotional engagement (Ruzek et al., 2016). A sense of relatedness can encourage positive student feeling towards a lesson (i.e., foster emotional engagement), and motivate students to participate in lesson activities (i.e., encourage behavioural engagement).

Student engagement and educational technology

Literature shows that educational technology influences how students behaviourally, cognitively and emotionally engaged in learning, and behavioural engagement is the most prevalent dimension (Bedenlier et al., 2020). In the systematic review study of Bedenlier and

colleagues (2020), most behaviourally engaged students in *online learning* had great abilities to interact online without the pressure of talking face-to-face, and to see how peers constructed their questions and responses in online collaborative environments. Most disengaged student *online learning* behaviours were caused by less autonomy-supportive environments (Bedenlier et al., 2020; Ryan & Deci, 2017; Chiu, 2021). The students who did not complete their share of the group work in blended learning and not sufficiently contribute to group discussion forums learned lost control in their learning. Teachers should consider student perspectives, allow for choices around learning, and reduce unnecessary stress and demands on students. Students should make their own choices and decisions with regard to their personal goals and self-efficacy, use their own voices to seek help, and in return feel empowered in learning (Ryan & Deci, 2017; Chiu, 2021). This engagement is a reliable predictor of academic achievement and disengagement prevention when the online tasks were less complicated (e.g. posting and responding in asynchronous tools) (Bedenlier et al., 2020; Chiu & Hew, 2018). Hence, behavioural engagement may be insufficient for effective *online learning* without the addition of cognitive engagement.

Cognitively engaged students invest more in *online learning*, seek to go beyond expectations, and enjoy challenges (Bedenlier et al., 2020; Chiu & Hew, 2018). They are more likely to use self-regulated approach to learn with technology (Bedenlier et al., 2020; Christenson et al., 2012; Fredricks, 2011) for deep learning - conceptual understanding rather than surface knowledge (Reeve, 2013). They not only attend to task instructions but also interact with content (e.g. discussion forum, blog) in a thoughtful, deep and own manner. In other words, autonomy-supportive online environments would cognitively engage students in self-regulated learning (Ryan & Deci, 2017); however, it has not been extensively studied in *online learning*

(Bedenlier et al., 2020; Christenson et al., 2012). Moreover, feeling incapable will experience diminished motivation to persist (Ryan et al., 2011). Bedenlier and colleagues (2020) indicated that students found stressed when failing to devote their time to online environments in blended learning, lacking their own computers at home to create digital assignments, and facing technical problems and difficulties in submitting their work for mobile learning. Therefore, teachers should support competence to cognitively engage students in *online learning* by offering students with choices for the tools and tasks, by aiding students with computer access, by assigning appropriate levels of tasks that feature practice vs challenge and by arranging technical support or training (Bedenlier et al., 2020; Chiu, 2021).

Emotional engagement that is manifested in the quality of relationships with teachers, peers, content, and learning activities (Wang & Eccles, 2013; Wang & Holcombe, 2010). Emotionally engaged students are more likely to find the activities and content fun and joyful (Bedenlier et al., 2020; Chiu et al., 2020). In emotionally engaging online environments, students replied blog or forum messages in a friendly manner, were able to create their own videos to work towards a shared group goal and build personal relationships (Bedenlier et al., 2020), as well as teachers encouraged positive peer supports and presented emotional multimedia designs for teaching (Chiu et al., 2020). However, in the environments, being unable to read body language and to receive immediate responses, and finding difficult to express ideas caused students disappointments (Bedenlier et al., 2020). Accordingly, it was more difficult for students to feel connected or related to *online learning*. Moreover, students might not have sufficient technology skills and experience in communicating online. This ineffective online communication would cause difficulties and frustrations for students due to the perceived incompetence. This emotional disengagement influences student willingness to complete their

tasks in *online learning* (Bedenlier et al., 2020). The emotional processes are important in learning; however, research on emotion in the context of *online learning* is scarce (Hsu et al., 2019).

Overall, *online learning* environments are less supervised (i.e., provide more autonomy), require technical skills (i.e., require digital competence) and lack physical human interactions (i.e., provide less relatedness support). Moreover, behavioural engagement in the environments is better understood, but not cognitive and emotional engagement (Bedenlier et al., 2020).

Research gaps

Most previous studies of online learning were conducted in post-secondary education (e.g., Bedenlier et al., 2020; Hsu et al., 2019; Sherer & Shea, 2011; Xie et al., 2019). Hence, we know very little how K-12 school students engage in online learning. Moreover, Ryan and Deci (2020) recently stated that research agenda for SDT-based future studies include investigations on how we support students' three innate needs in technology enhanced learning. How the three psychological needs in SDT support the three engagement dimensions are understudied (Hsu et al., 2019; Ryan & Deci, 2020), particularly in school education.

This study and Methods

Collectively, the three engagement dimensions raise important questions not only regarding the theoretical justifications for, role and relevance of *online learning* specifically, but also regarding K-12 situations in which cognitive and emotional engagement is understudied (Bedenlier et al., 2020). Where these conditions exist there are also opportunities to study SDT in new contexts – K-12 school online learning (Hsu et al., 2019). Qualitative research unearths the

opinions, thoughts and feelings of respondents and has been used frequently to describe and examine the results of educational technology experiences (Tondeur et la., 2012). This research approach provides insights into the reasons why new contexts succeed or fail (Atkins et al., 2008), and is most commonly used to help inform new concepts and phenomenon. Therefore, this study adopted a qualitative approach to understand how K-12 students cognitively and emotional engage and disengage in online learning from students and teachers perspectives, where happens this year during the pandemic, through the lens of SDT. Accordingly, the research question is

> To what extent has the senses of autonomy, competence, and relatedness
> in *online learning*, and how they foster or discourage cognitive and
> emotional engagement?

Participants and sampling

Participants were students and teachers from a pool of 48 partnership schools in Hong Kong that offered asynchronous and synchronous online learning during the school closures. The asynchronous and synchronous online learning were learning videos and discussion forum in learning management system and real-time lesson, respectively. This study used purposeful sampling, seeking those who could speak to our study objective and were readily accessible to the research team (the author and 3 experienced research assistants) during the challenging time of the pandemic, to make sure that students with a broad range of academic ability were recruited. Twelve students (age 12-17) and six teachers from each band in the pool were randomly selected (secondary schools in Hong Kong are categorised into three bands based on student academic achievement), resulting in 30 male and 24 female participants. This sample size

(54) is sufficient to generate codes for thematic analysis (Ando, Cousins, & Young, 2014). All participants were informed of their rights and provided informed consent before participating.

Data collection and analysis

A protocol for the semi-structured interviews was derived from the study of Christenson et al., 2012) and verified by 2 experienced teachers to make sure the language understandable, and was grounded in the research objective and the theoretical underpinnings supporting this study. The protocol aimed to facilitate open discussions and the collection of in-depth perspectives. The interviews explored (i) what and how *online learning* support psychological needs and dimensions of engagement; (ii) opportunities to foster student and teacher abilities and skills; (iii) challenges to designing online environments that cognitively and emotionally engage students in learning; (iv) obstacles that disengage students from *online learning*. A research assistant transcribed the audio recordings verbatim and audited all transcripts to ensure accuracy.

A hybrid inductive and deductive thematic analysis was used to identify patterns and themes related to the theoretical framework. It offers a useful method for working within participatory research paradigm to inform policy (Braun & Clarke, 2006). Accordingly, this study used five steps, guided by Braun and Clarke's (2006) theoretical constructs to analyze the data in NVivo, which ensure its truthfulness, credibility, and trustworthiness.

- Step 1: Becoming familiar with the data. A research assistant read and re-read transcripts line-by-line.
- Step 2: Generating initial codes. The assistant annotated transcripts with codes that described notable content.

- Step 3: Searching for themes. A different researcher assistant reviewed all annotated transcripts to thoroughly examine codes and to identify any differences in interpretations. The author acted as the mediator of any differences in interpretation. They analyzed the codes to generate initial themes.

- Step 4: Reviewing themes. The team may group some existing themes together or split some theme into subthemes. This process was repeated until the team were satisfied with the thematic map.

- Step 5: Defining and naming themes. The team defined names that provided a full sense of the theme and its importance.

Results and Discussion

The analysis identified the two major themes from the data as 'More autonomy-supportive environments' (Theme 1) to cognitively engage students in fostering student lifelong skills and 'Less competence- and relatedness- supportive environments' (Theme 2) to suppress cognitive and emotional engagement. Each theme is discussed in more detail below using pseudonyms to protect the participant identities.

Theme 1: More autonomy-supportive environments

Theme 1 describes the fostering environments that the students and teachers perceived for more autonomy support via the *online learning* environments offered, and student choices to cognitively engage in developing lifelong skills of self-regulated learning and digital literacy.

Theme 1.1: Self-regulated learning ability development (autonomy and cognitive engagement)

The students and teachers viewed the *online learning* as an opportunity to foster student self-regulated learning, taking advantage of what the students perceived to be a comparatively less controlled environment with a number of opportunities to engage in setting goals, and for monitoring, regulating and controlling their own learning. The analysis showed that the students gained a stronger awareness of monitoring their own learning and making their own choices of learning methods, as illustrated by the following excerpts.

Stronger awareness of monitoring learning

- *"I was surprised that my students used some methods to solve problems I did not introduce."*(Teacher1)

- *"I had more time and flexibility to think about how to approach the tasks."*(Student1)

- *"I was able to choose learning methods I preferred to solve the problems. I enjoyed having this freedom."*(Student4)

Online learning encouraged the students to take control of their own learning and they were given the chance to try tasks on their own, which is aligned with the contextual factors that play a role in the development of self-regulation. This personal endorsement or sense of choice reflects the need for autonomy in SDT (Ryan & Deci, 2017; Robertson et al., 2020). Compared to face-to-face classrooms, online environments are less supervised, providing the students with more autonomy to manage their learning and encouraging them to cognitively engage in choosing their learning materials (Ryan & Deci, 2017; Ruzek et al., 2016). The environments also give students the flexibility to choose their preferred learning strategies to engage in a way

that suits them when completing learning tasks. Moreover, in the absence of teachers, students receive less direct instruction from teachers and are forced to motivate themselves to make their own decisions about their learning (Ruzek et al., 2016). It is demonstrated by the following excerpts.

<u>Less supervised environments</u>

- *"I was unable to get immediate help from the teachers; therefore, I studied different solutions online and picked the best one for the homework."*(Student3)

- *"In face-to-face lessons, my teacher presence encouraged me not to monitor my learning. Basically, they did it for me."*(Student8)

- *"My students seemed to be learning subject content I did not include in the lessons."*(Teacher)

- *"My students submitted their assignments when they were ready."*(Teacher6)

Theme 1.2: Digital literacy development (autonomy and cognitive engagement)

Online learning was viewed as advantageous because the virtual environment gave the students an opportunity to cognitively engage repeatedly in various technical skills through trial and error cycles, and better developed their digital literacy (Bedenlier et al., 2020). Digital literacy includes using devices and handling information, creating and editing, communicating online, and being responsible, safe and legal online. Nearly all of the students and teachers emphasised that they developed better technical skills, see the following excerpts.

<u>Enhancement of technical skills</u>

- *"I learned how to make good instructional videos for online lessons. So happy. Never done it before."*(Teacher1)

- *"Now I am more aware of data ethics and privacy."*(Teacher9)

- *"I designed, made and evaluated videos for my assignments. It took days; however, I enjoyed making them."*(Student4)

- *"Learning* [how to use] *the app is a must for me to attend the lesson."*(Student5)

- *"My IT skills are better*."(Student8)

The students and teachers expressed that they developed better skills to interact/collaborate with others online through speaking and using images, and making better instructional videos and pictures. These digital communication skills are essential for interactions in *online learning* (Bedenlier et al., 2020). Mastering these skills were able to effectively digitally exchange information in synchronous and asynchronous ways, as demonstrated by the following excerpts.

<u>Digital communication skills</u>

- *"I can speak better to my students in real-time online lessons. I gained knowledge to communicate with them through multiple representations/channels."*(Teacher7)

- *"I gained knowledge about making good images to present the subject content in forums and real-time lessons."*(Teacher8)

- *"I collaborated with my classmates online on a project. We worked on a slideshow together. It was my first time to do it at home."*(Student2)

- *"I made images and videos to share my ideas in discussion forums."*(Student4)

All communication in *online learning* is via digital media, which is different from classroom learning, in which most communication is verbal. The students felt they needed to improve their digital proficiency before taking part in online activities (Bedenlier et al., 2020),

answering and replying to questions on forums or marking and finishing assignments. This need to produce desired outcomes and to experience personal mastery reflects the need for competency in SDT and may cognitively engage teachers and students (Ryan & Deci, 2017; Robertson et al., 2020). Autonomy support offered by *online learning* can also facilitate cognitive engagement (Bedenlier et al., 2020; Christenson et al., 2012) leading to the development of better technical skills. Given the speed and impact of the public health crisis, schools and teachers had to implement solutions as soon as possible. This emergency moves to *online learning* quickly fostered a more autonomous environment for students and allowed them to choose to practise the technical skills they wanted to master.

Theme 2: Less competence- and relatedness- supportive environments

Theme 2 addresses the students and teacher views about the challenges of engaging in *online learning* involves a lack of emotional attachment, student digital incompetence, student ineffective learning experiences and a lack of home equipment and resources.

Theme 2.1: Lack of emotional attachment (relatedness and emotional engagement)

The first challenge identified by the students was that instructional designs focused primarily on behavioural engagement and failed to emotionally engage them in *online learning*. The teachers adapted and evolved classroom teaching practices away from a focus on homework assessment and predefined teaching schedules and syllabuses to an *online learning* that caters to individual learning needs and takes account of student concerns and barriers. The *online learning* context was viewed as an obstacle to the students developing a stronger of sense of belonging because it was considered a comparatively less warm and expressive environment. In

comparison to interaction in face-to-face classroom settings, *online learning* proved disadvantageous in terms of emotional attachment (Bedenlier et al., 2020). The students did not describe the online interactions as relationship-building opportunities, often contrasting them with opportunities to learn more subject knowledge such as through peer learning; developing a stronger sense of belonging was viewed almost as an ancillary benefit. The students indicated that their primary reason for behavioural engagement was to respond to requests from schools and teachers, see the following excerpts.

Emphasis on behavioural engagement

- *"I expected my students to watch all the videos."* (Teacher2)

- *"I was told to attend all of the live lessons."* (Student1)

- *"I participated in the activities because I was told to do so."* (Student7)

Lack of emotional attachment

- *"I should have emotionally engaged my students in learning."* (Teacher2)

- *"I found I did not know the teachers and classmate well."* (Student3)

- *"I did not belong to class 3A."* (Student6)

- *"My teachers just talked about the content."* (Student10)

- *"The lessons are more like tutorial sessions."* (Student18)

The lack of emotional attachment highlights the importance of relatedness support for effective *online learning*, particularly in times of societal and/or public health crisis, but it is neglected in most instructional designs for *online learning* (Bedenlier et al., 2020; Ruzek et al., 2016; Wang & Eccles, 2013). Emotional support should be the focus for *online learning*, particularly in a time of challenges such as social distancing, school closures and city lockdowns.

Theme 2.2. Digital incompetence (competence and emotional engagement)

Nearly all of the students and teachers expressed that digital literacy was a prerequisite for online learning, and emphasised its importance in *online learning*. However, the students expressed that they spent a lot of effort and time to learn how to use educational technology before learning online. It was frustrating and discouraging, see the following excepts. Students with better digital literacy perceived competence are more likely to emotionally engage in *online learning* (Bedenlier et al., 2020; Chiu, 2021).

Digital literacy was a prerequisite

- *"I cannot teach online without knowing how to make good instructional videos."(Teacher 3)*

- *"I learned how to make good instructional videos for online lessons."(Teacher 5)*

- *"Learning how to reply in discussion forums is a must for me to attend the lesson."(Student 5)*

- *"Learning how to upload files is necessary for me to interact with my students."(Student 7)*

Great effort to learn how to use educational technology

- *"I spent too much time on working out how to make a video."*(Student 11)

- *"Learning the XXXX (tool) was time consuming. Very frustrating"*(Student 28)

- *"I spent a week to work out how to use the system. .... It was too much."*(Student 31)

Theme 2.3: Ineffective learning experience (competence and cognitive engagement)

The ineffective learning experiences the students identified were viewed as highly dependent on the quality of instructional videos, the formats of the learning resources, and the proficiency of teacher digital communication skills. In many cases, the online provision was problematic when students did not understand the content. This experience made the students feel incompetent and discouraged from learning more.

> *"I did not understand what my teacher talked about. He spoke too fast."*(Student 5)
>
> *"I believe that my teacher did not teach well online, but she was very good in the classroom."*(Student 12)
>
> *"The quality of videos is too bad (in terms of learning)."*(Student 19)
>
> *"I could not ask for help to finish the task like I did in the classroom … the task was similar to classroom learning."*(Student 20)

A plausible explanation for this ineffectiveness is that teacher efforts might not engage a diverse learning community with variable access to and resources for e-learning. The teachers might not have sufficient knowledge about designing effective teaching resources (Chiu & Churchill, 2015) such as videos and activities to avoid cognitive overload (Chiu et al., 2020). They were unable to design instructions to cognitively engage students in learning, so that the students had feelings of incompetence and failure. They applied their methods for teaching in classrooms to online learning; however, pedagogies for the two contexts are very different Bedenlier et al., 2020; Hsu et al., 2019; Sherer & Shea, 2011).

Theme 2.4: Lack of home equipment and resources (competence and cognitive engagement)

The last challenge was related to lacking home equipment and resources. The analysis indicates that disadvantaged students were challenged by the move to *online learning*. Lacking home equipment and resources and internet access were obstacles to equitable and effective *online learning* (Bedenlier et al., 2020). Some students had to borrow equipment (such as computers or internet services) from schools and other organisations.

> *"My school lent me a computer and Internet access service."*(Student 29)
>
> *"I shared a computer with my brothers and father, very difficult."*(Student 30)
>
> *"I used an iPad to learn because I did not have a computer. I found it difficult to read the materials."*(Student 31)

The findings supported the assertion that a digital divide and educational inequity exist. Teachers assigned homework and activities that required broadband internet, but the students had the experience of not being able to complete homework and activities due to a lack of internet or computer access (Bedenlier et al., 2020). The disadvantaged students felt incompetent and were unable to cognitively engage in *online learning* (Bedenlier et al., 2020). The emergency online teaching has made the digital divide worse and more dangerous than ever. The importance of getting students online during this difficult time cannot be understated. Good devices and reliable internet connections enable students to keep up with their schooling and stay connected to their teachers and class, resulting in perceiving competence support.

Empirical and practical implications

As previously discussed, little or no relevant studies were conducted. This study suggests online learning offered different senses of autonomy, competence and relatedness would foster and suppress cognitive and emotional engagement. It affords two major empirical contributions,

and they are (i) the *online learning* settings are viewed as autonomy-supportive environments and spaces in which to develop two student lifelong skills (Themes 1.1 and 1.2); however, (ii) the settings are less competence and relatedness- supportive environments, and fail to cognitively and emotionally engage students in learning (Themes 2.1 - 2.4). The autonomy-supportive environments offered by *online learning* can be seen as opportunities for students to cognitively engage in fostering their self-regulated learning and digital literacy; the nature of *online learning* that requires good digital competences and reliable home equipment, as well as are less warm and expressive can be seen as challenges of fostering cognitive and emotional engagement.

Moreover, this study also affords four practical implications for preparing and implementing *online learning* by supporting student needs for competence and relatedness.

Student preparation (competence-supportive)

The first practical implication is that school students should be prepared to learn online. This emergency transition to *online learning* has provided school students with opportunities to develop beneficial lifelong skills (Themes 1.1 and 1.2); however, they might not master these skills on their own (Theme 2.2). Well prepared students are more likely to perceive a stronger sense of competence, resulting in higher levels of motivation in *online learning*. Therefore, schools should strengthen (i) student digital communication skills (such as emotional expression), (ii) ability to use technology to monitor learning (Themes 1.1 and 2.2), (iii) online peer learning skills and (iv) online collaboration capabilities (Theme 1.2 and 2.2), and cultivate an *online learning* culture or routine (Theme 2.3).

Teacher competency in instructional design (competence-supportive)

Teacher competency in instructional design is crucial to student cognitive engagement (Theme 2.3). In *online learning*, the engagement is strongly associated with teacher digital presentation skills and the quality of resources (Sherer & Shea, 2011). However, most school teachers have had little or no training in digital communication skills, or learning-efficient resources production (Theme 2.3). Teacher professional training should be strengthened by

- enhancing their digital communication skills such that teachers learn how to use multimodal resources to cater to learner diversity (Chiu & Mok, 2017) (Theme 2.3);

- enhancing skills in showing positive attitudes and enthusiasm online (relatedness) to establish positive teacher–student relationships and better emotionally engage students in learning (Theme 2.1); and

- enhancing teacher capacity to design and produce teaching-efficient videos, for example by applying multimedia learning principles or emotional designs when making learning resources (Chiu et al., 2020) (Theme 2.3).

Design for high accessibility (competence-supportive)

The accessibility of learning platforms and resources determines the quality of student learning (Theme 2.4). Therefore, this study suggests the followings:

- Most families own mobile devices that have small screens and require less bandwidth. Teachers should do their best to redesign current activities into activities suitable for small screens, so that students can easily view required electronic materials via their phones (Chiu & Churchill, 2016). (Theme 2.4).

- Use off-line tasks as primary instructional strategies (Theme 2.4). Shortening online activities encourages the disadvantaged students to participate. Example tasks include audio- and video-records as assignments; taking pictures of completed writing articles.

Design for high-quality teacher–student relationships (relatedness-supportive)

The findings show that efforts to foster behavioural engagement might not be as important as previously thought in *online learning* (Theme 2.1). Rather, greater consideration should be given to emotional attachment. High-quality teacher–student relationships are the critical factor in determining student emotional attachment (Theme 2.1). The relationships can be facilitated by displaying positive attitudes and enthusiasm and increasing one-on-one time with students. Schools and teachers should (i) formulate *online learning* guidelines, such as establishing online peer support groups and including more interdisciplinary group learning activities, and (ii) arrange activities to let students express their emotions and experience about their work and *online learning*.

Conclusion, limitations and suggestions for further research

This study is timely in that it allows researchers and educators to better understand the opportunities (autonomy-supportive) and challenges (less competence- and relatedness-supportive environments) school students and teachers face in *online learning during the pandemic*. Our findings highlight that the opportunities for school students include developing the two important lifelong skills of digital literacy and self-regulated learning. The four challenges raised by the different pedagogical foci and communication interfaces of online and school learning contexts. They are teacher insufficient knowledge of cognitive and emotional

engagement and student digital incompetence. By responding to these challenges governments can establish education policies to *online learning*.

This study acknowledges three important limitations of this study: First, our findings may be reflective of our specific context, Hong Kong, which has reliable and established internet connections, and may not be fully generalisable to locations with unreliable internet connection. Therefore, future studies should be conducted in rural areas or large territories. Second, this study adopted a qualitative approach and were thus unable to identify how the three psychological needs of SDT relate to three dimensions of student engagement. A co-relational study should be conducted to examine whether and how these factors relate to each other (Christenson et al., 2012). Third, this study did not investigate how different pedagogies supporting the three psychosocial needs engage students in learning. An empirical study is suggested to identify factors that influence student engagement in online learning (Christenson et al., 2012).

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