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REVIEW ARTICLE

Promoting engagement in online learning beyond COVID-19: Possible strategies and directions for future research

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Abstract

In the aftermath of the global pandemic, online learning is now ubiquitous around the world. Yet, although online learning has become a common learning approach across the globe, it is still viewed as a weaker option than on-campus face-to-face learning. Specifically, the lack of student engagement in online learning poses a persistent problem to many educators. In this article, we describe three key challenges of fully online learning: students being more easily distracted, students lacking self-regulation skills and students feeling isolated. Next, we present three possible strategies to address these challenges: promoting active learning through the online flipped classroom model, promoting self-regulation skills and reducing the sense of isolation through the use of chatbots. For each of the three strategies, we provide a description with relevant empirical studies based on our own work as well as previous work in the literature and discuss possible directions for further research.

KEYWORDS

chatbot, engagement, flipped classroom, online learning, self-regulated learning

1 | INTRODUCTION

The COVID-19 pandemic hit the world explosively at the start of Spring 2020, eventually causing widespread disruption to people's work and life. The pandemic has upended the delivery of education as we know it. Instead of the traditional face-to-face lesson in which students and teachers interact in person, which we are familiar with, we rely on web-based video-conferencing platforms, such as Zoom, as a primary instructional medium (Okabe-Miyamoto et al., 2022). Although the World Health

Organization has recently declared an end to COVID-19 global health emergency (United Nations, 2023), and many courses have reverted to traditional face-to-face teaching, online learning will continue to become an option for students to complete their courses after the pandemic due to its flexibility and convenience (Dos Santos, 2022). Furthermore, even though the current pandemic has ended, there is a critical need for schools to plan for robust online lessons to deal with possible future school closures due to new pandemics or other disasters.

Online learning, however, often suffers from a lack of student engagement (Bai et al., 2022). For example, a survey of 3089 North American higher education students revealed that more than 75% of respondents found online experiences not engaging (Read, 2020). Another survey of 187 undergraduate students had similar results with 72% of respondents reporting low engagement with online learning experience (Hollister et al., 2022). More alarmingly, a recent study reported that state test scores declined significantly in both reading and math during the pandemic, and that these declines were larger in school districts that kept classes fully online (Jack et al., 2023). Clearly there is an urgent need for educators to make online learning a more engaging experience for students.

2 | STUDENT ENGAGEMENT

Student engagement is a critical determinant to student learning. It has been associated with better learning outcomes (Hao et al., 2018), enhanced motivation of learners (Fredricks et al., 2004) and positive learning behaviours (Taylor & Parsons, 2011). Although there is no universally agreed-upon definition of engagement, it is widely accepted as a multifaceted concept (Finn & Zimmer, 2012) encompassing three components: behavioural, emotional and cognitive engagement (Fredricks et al., 2004).

Behavioural engagement refers to the effort, attention and persistence of students in their learning and academic activities (Fredricks et al., 2004). This includes students' active participation in discussions, their performance of academic tasks (Gregory et al., 2014), their adherence to school rules and the frequency with which they ask questions (Fredricks et al., 2004). Emotional engagement refers to students' affective reactions, either positive or negative, to their learning environment, their teachers or their peers (Fredricks et al., 2004). Reactions may include interest, enthusiasm or boredom (Skinner et al., 2008). Cognitive engagement has two key aspects (Fredricks et al., 2004). The first is students' investment in learning—in other words, students' psychological effort to understand and master knowledge and skills. The second is students' strategic and self-regulated learning, such as their use of meta-cognitive strategies to perform and monitor various learning activities and tasks (Finn & Zimmer, 2012).

Despite the advantages of online courses, such as convenience and flexibility to students, which give students the autonomy in determining where and how they study, more often than not, online courses suffer from a lack of student engagement (Starr-Glass, 2020). Symptoms of disengagement include students not participating in or withdrawing from course activities (Chipchase et al., 2017). Research on student disengagement has often remained overlooked (Bergdahl, 2022). Some contributing factors that can cause student disengagement in online courses include students being more easily distracted (Lodge et al., 2022), students lack self-regulation skills (Barrot et al., 2021) and the sense of isolation (Chametzky, 2021).

2.1 | Distraction

Although online learning provides flexibility to students regarding the choice of when, where and how to study, students are easily distracted from their online study (Lodge et al., 2022; Maqableh & Alia, 2021). More specifically, distractions can be defined as attention being diverted from the primary task to secondary tasks (Wang, 2022). Distracted learning can adversely affect student learning (Schmidt, 2020). Examples of distractions in online learning include using digital devices and mind-wandering (Wang, 2022). Digital devices typically refer to electronic tools such as smartphones and tablets that are used for leisure purposes (Flanigan & Kim, 2022). Since online learning occurs mainly in students' homes rather than in traditional classrooms under the watchful eye of the instructors, students find it harder to maintain focused attention during online lessons (Wang, 2022). A recent study found a significant difference between online and face-to-face learning modes, with a whopping 95% of students saying that they used their devices in online courses for non-course related purposes, compared to 75% in face-to-face classes (Aivaz & Teodorescu, 2022). Students were more likely to use their digital devices to read or send emails or text, as well as surf the Internet in online classes than face-to-face classes (Aivaz & Teodorescu, 2022).

Mind-wandering, a ubiquitous daily phenomenon, is another form of distraction. More specifically, mind-wandering can be defined as a shift in attention away from a primary task to unrelated self-generated thoughts (Smallwood & Schooler, 2006). Previous research has observed that mind-wandering often occurs during lectures where it is common for at least a third of the students to mind wander (Pan et al., 2020). Mind-wandering appears to occur more frequently when students watch recorded video lectures (Conrad & Newman, 2021). Wammes and Smilek (2017), for example, reported that participants who watched a lecture in recorded video format showed a significant increase in mind-wandering over the duration of the lecture, while participants who viewed the same lecture in-person did not. Mind-wandering experience is, unsurprisingly, associated with lower levels of academic performance (Hollis & Was, 2016; Schacter & Szpunar, 2015).

2.2 | Lack of self-regulated learning skills

Self-regulated learning is a form of learning where the learner is primarily responsible for managing their own learning. The need for self-regulation becomes more acute in online learning since students have more autonomy over their learning process (Hew et al., 2023). The self-regulated learning construct encompasses a large number of variables that can influence learning such as cognitive strategies, metacognitive strategies, self-efficacy and emotional aspects among others (Panadero, 2017). Different self-regulated learning models have been proposed to help make sense of the construct. Among the various models, Zimmerman's model is one of the most widely cited (Panadero, 2017). According to Zimmerman (2013), self-regulated learning contains three phases (forethought, performance and self-reflection), with each phase representing a process that occurs before learning, during learning and after the learning effort, respectively. The forethought phase refers to the stage where students plan for learning. This planning stage includes students setting short- and long-term goals concerning their learning and selecting strategies that can best achieve the goals. The performance phase refers to students implementing their selected strategies and making ongoing revisions to their plan when necessary as they monitor their performance during learning. The self-reflection phase refers to processes that occur after learning where students reflect on their learning experience and evaluate the effectiveness of their strategies. These self-reflections can inform subsequent forethought processes (Zimmerman, 2013). Self-regulated students tend to do better in their learning performance (Akdeniz, 2022). However, many online students lack self-regulation skills and are ill prepared for autonomous learning (Wong et al., 2021). This can cause students to feel disengaged from the online activities.

2.3 | Sense of isolation

In addition to the lack of self-regulated learning skills and being easily distracted, online students frequently reported feeling isolated during online activities (Chametzky, 2021). Often the physical and temporal separation of instructor and student and between student and student in online learning can cause feelings of isolation (Croft et al., 2010). Additionally, the physical separation can lead to a psychological and communications gap—what Moore (1991) calls transactional distance, a space of potential misunderstandings between people.

One possible way to relieve feelings of isolation in online learning is to promote the sense of social presence (Hew et al., 2023). Social presence can be defined as 'the ability of participants to project themselves socially and emotionally, as real people' (Garrison et al., 1999, p. 94). Social presence can alleviate stress and the feeling of loneliness (Whiteside et al., 2014) as well as increase student satisfaction with the course (Richardson et al., 2017).

Although recent web-based video-conferencing apps, such as Zoom, allow people to see and hear each other simultaneously online and thus the affordance to increase social presence (Giesbers et al., 2009), it does not guarantee that feelings of isolation can be eliminated in an online setting. In fact, using video-conferencing apps can amplify the existing sense of isolation for some people (Entis, 2020). Moreover, not all students are willing to turn on their webcam during the Zoom classes due to reasons and concerns such as being concerned about their own appearance (Castelli & Sarvary, 2021).

3 | POSSIBLE STRATEGIES TO ADDRESS STUDENT DISENGAGEMENT

In this section, we discuss three possible strategies to address the aforementioned challenges: promoting active learning through the use of online flipped classroom models, promoting self-regulation skills and reducing the sense of isolation through the use of chatbots. These strategies should not be considered as an exhaustive list of means to deal with student online disengagement. For each of the strategies, we will first provide a description with relevant studies based on our own work as well as previous work in the literature, and then discuss directions for further research.

3.1 | Promoting active learning through the use of online flipped classroom

Active learning can be defined as instructional activities that involve students in doing things and thinking what they are doing (Bonwell & Eison, 1991). Active learning is often contrasted with the lecture approach (Phillips, 2005) or teacher-centred or teacher-directed method where the teacher talks most of the time (Børte et al., 2023). More specifically, Meyers and Jones (1993) have identified elements of active learning as cognitive activities that require students to clarify, question, consolidate and appropriate new knowledge through four primary means: talking and listening, reading, writing and reflecting. A study involving 186 students from six campuses in the Midwest USA reported a number of active learning strategies that students found engaging in online courses, including application tasks (having to apply concepts to case studies or problem solving) and discussion forums (Dixson, 2010). Active learning can be a useful strategy to curb student digital distractions. For example, 72% of 538 undergraduates from four universities in the USA indicated that active learning is either moderate or very effective for preventing student digital distractions from happening (Flanigan et al., 2023).

In recent years, the evidence for the positive effects of active learning on student learning has been growing. Freeman et al. (2014), for example, synthesised 225 research studies comparing active learning and lecturing, and found an overall positive significant effect due to the former across the science, technology, engineering and mathematics (STEM) disciplines. Active learning can also narrow achievement gaps in examination scores by 33% and passing rate by 45% for students underrepresented in STEM compared to lecture (Theobald et al., 2020). More recently, Ibrahim et al. (2022) reported a 2-year study of active learning in physics and astronomy courses involving 2145 students in the Middle East and Northern Africa. They found positive effects of active learning (e.g. quizzes); student mean course score improved by 9% and the failure rate of students in active learning courses was reduced to a third of that of traditional classes relied mainly on lecturing.

One way to incorporate active learning into an online course is the fully online flipped classroom model. An online flipped classroom is similar to its traditional counterpart—the conventional flipped model in that both contain pre-class learning activities, followed by in-class activities (Hew et al., 2020). However, the in-class activities in an online flipped classroom occur synchronously via video-conferencing tools such as Zoom (see Hew et al., 2020; Jia et al., 2023 for examples). The flipped classroom model has become synonymous with active learning (Børte et al., 2023) because it frees in-class time for students to participate in learning activities by moving lectures to the pre-class session. By giving students more opportunities to engage in active learning, the flipped classroom model has demonstrated a greater positive effect on students' learning performance than the non-flipped approach. So far, the evidence regarding the effects of flipped classroom on student achievement has been encouraging. Numerous meta-analyses have found that flipped classroom significantly improved student learning compared to traditional classroom teaching with effect sizes ranging from 0.19 to 1.13 (Hew et al., 2021).

Nevertheless, despite the overall positive effects of the flipped classroom model on student outcomes, there are several student-related challenges that can undermine the use of the model. Based on our own research work and review of the literature, we arrive at several key student-related challenges of flipped classrooms, including its online counterpart—the fully online flipped classroom model (Figure 1). These challenges may be classified into three main groups: students' resistance towards the new instructional model, students' lack of engagement with the pre-class work and students' lack of engagement with the synchronous online lessons.

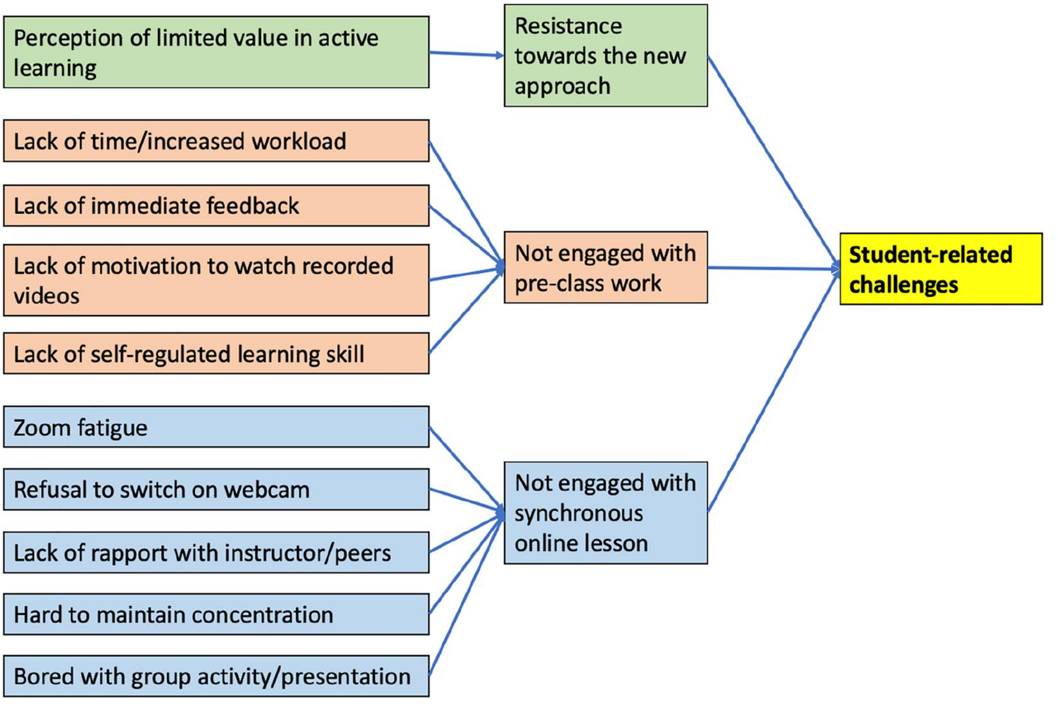

FIGURE 1 Some of the key student-related challenges of the flipped classroom model.

3.1.1 | Students' resistance towards the new instructional model

Students may show resistance to the flipped classroom model by refusing to participate in the learning activities (passive resistance), complete the activities by rushing through them without enthusiasm (partial compliance) or complain about the teaching approach often during class (open resistance) (Weimer, 2013). Students' resistance towards the instructional model may be due to students' perception of flipped classroom being of limited value to their learning (Akçayır & Akçayır, 2018; Ward et al., 2018). Missildine et al. (2013), for example, reported that flipped classroom students were significantly less satisfied than students using the traditional lecture approach because they did not perceive the value of the interactive in-class learning activities (a form of active learning) in the flipped classroom model. Some of the reasons why students think active learning has limited value is student preference for teacher-directed instruction and the extra cognitive effort needed to construct knowledge (Deslauriers et al., 2019; Owens et al., 2020). Unlike teacher-directed instructions such as lectures where students mainly listen to content knowledge delivered by the teacher, active learning requires students to cognitively struggle through questions or problems that they initially did not know how to solve (Deslauriers et al., 2019). The extra cognitive effort to construct knowledge was not appreciated by every student (Owens et al., 2020). Even though students in active learning classes performed better than those in lecture-centred classes, the former perceived they learned less and wished all their lessons were taught using lectures (Deslauriers et al., 2019).

3.1.2 | Students' lack of engagement with pre-class work

Even if students are open to the flipped classroom model, not everyone is fully engaged with pre-class work. One common complaint is the additional time required to do pre-class lesson activities (Bond, 2020; Lo, 2023; Lo & Hew, 2017). Since the success of flipped classroom is contingent on students coming prepared to the in-class meeting, it is imperative that students complete the pre-class activities. This is unlike a traditional classroom where students can sit through the lesson without prior preparation (Jia et al., 2023). The need to complete the pre-class work in a flipped classroom can be seen as extra homework by students (Akçayır & Akçayır, 2018; Bond, 2020). Not every student appreciates the additional workload. The pre-class work can be made more onerous if students cannot ask questions directly to the instructor (Akçayır & Akçayır, 2018; Lo & Hew, 2017) and therefore lack immediate feedback to the things they are not sure of when viewing videos or content at home.

Students may also lack the motivation to watch the recorded video lectures due to reasons such as the length of the videos, poor audio quality, videos not created by the course teacher and perception that videos are less important than worksheets (Akçayır & Akçayır, 2018; Bond, 2020). Additionally, the success of the flipped classroom model relies on the ability of students to self-regulate their own learning (van Alten et al., 2020a). As mentioned previously, self-regulated students tend to achieve better academic performance than those who lack such skills (Du & Hew, 2022). However, not all students can self-regulate their learning effectively, especially in the pre-class phase of the flipped classroom model. The self-paced learning mode required during the pre-class phase requires students to take responsibility to plan, monitor and evaluate their individual learning with minimal or no guidance from the teacher.

3.1.3 | Students' lack of engagement with the synchronous in-class lessons

The fully online flipped classroom model adds an extra layer of complexity to the task of engaging students since the synchronous in-class meetings are no longer done in person but via video-conferencing tools such as Zoom. Not all students are enthusiastic about participating in Zoom-mediated synchronous lessons. Serhan (2020), for example, found that only 22% of students agreed they enjoyed using Zoom in class and only 19% of students would like to use Zoom in other classes. A more recent survey of 400 students by Eastern Oregon University revealed that 33% of the respondents were less willing to answer the instructor's questions and 30% were less willing to participate in class discussions during Zoom sessions compared with traditional face-to-face lessons (Cavinato et al., 2021).

Students' lack of engagement with the synchronous online lessons may stem from Zoom fatigue. Zoom fatigue, a synonym for video-conferencing fatigue, may be defined as perceptions of exhaustion, anxiety, stress or other bodily symptoms (e.g. headaches) caused by intensive use of video-conferencing tools (Riedl, 2022). Possible causes of Zoom fatigue include the lack of body language, unnatural interaction with multiple faces on screen, dissatisfaction with facial appearance, social interaction anxiety and multitasking during videoconferences (Ratan et al., 2022; Riedl, 2022).

Not switching on the webcams can also cause students to be disengaged with the synchronous online lesson (Maimaiti et al., 2021). If the webcam is turned off, students can become easily distracted and engage in other off-task activities (e.g. chatting on phone) while the lesson is going on (Maimaiti et al., 2021). However, the use of webcam can be a double-edged sword—while it helps students to pay attention to the synchronous lesson, it can also cause Zoom fatigue (Ngien & Hogan, 2022). Additionally, the absence of in-person interaction can lead to a dearth of the sense of connection between student–student and student–teacher (Jia et al., 2023). A lack of rapport with instructors and peers can cause students to be less engaged with synchronous online lessons (Serhan, 2020). Students also feel it difficult to maintain concentration during the synchronous online lesson, especially if the instructor decides to talk continuously on Zoom (Maimaiti et al., 2021). Finally, students feel disengaged when listening to their classmates' online presentation (Jia et al., 2023; Lo, 2023). For example, students complained that a 30-min group presentation was too long (Jia et al., 2023).

4 | DIRECTIONS FOR FURTHER RESEARCH CONCERNING ONLINE FLIPPED CLASSROOMS

Table 1 lists some possible strategies to address the challenges of an online flipped classroom. These strategies are, of course, not exhaustive. It is beyond the scope of this paper to discuss each of the possible strategies in detail. In this section, we shall discuss two directions for further research concerning online flipped classroom: motivating students to participate in the pre-class and in-class activities using gamification and promoting students' self-regulation skills.

4.1 | Motivating student participation using gamification

Researchers have often suggested using incentives such as giving low-stakes course marks to motivate students' participation in flipped class activities (e.g. Lo, 2023). While marks can be helpful, some students may feel stressed by the pressure to participate in the class (Grolnick & Ryan, 1987). Moreover, giving marks does not guarantee that students will automatically participate in the flipped class activities especially during the synchronous in-class online sessions. For example, Jia et al. (2023) reported that online students failed to participate as actively as their counterparts in face-to-face sessions even though the online students' in-class participation counted for as high as 20% of their course grade.

Against this backdrop, gamification may be a promising solution. Gamification, in essence, refers to the application of game elements, such as leaderboards and badges, to motivate learners' behaviour (Educause, 2011). Over the past 9 years, the first author and his research team have explored the

TABLE 1 Possible strategies to address the challenges of online flipped classroom.

Key challenges	Contributing factors	Possible strategy
Resistance towards the new approach	Perception of limited value in active learning	• Use *explanation* (e.g. explain the purpose of the learning activity and discuss how the activity can improve student learning) and *facilitation* (e.g. approach students who are not participating in the activity) instructional strategies to reduce student resistance to active learning (Andrews et al., 2022)
Not engaged with pre-class work	Lack of time/increased workload	• Allow adequate time (e.g. 1 week) for students to manage their pre-class workload (Lo, 2023). • Use low-stakes points to encourage student participation in pre-class work (Lo, 2023). • Provide students with gamified incentives to motivate them to prepare for class (Jia et al., 2023)
	Lack of immediate feedback	• Use a mobile instant messaging app (e.g. WhatsApp and WeChat) because it can foster higher student engagement level than an online forum (Tang & Hew, 2022)
	Lack of motivation to watch recorded videos	• Interpolate video lectures with short-answer quizzes to improve student learning and reduce mind wandering (Szpunar et al., 2013). • Keep each video within 6 min (Guo et al., 2014). • A total of 20–25 min for all combined video segments would be a bearable workload for most students (Kennedy et al., 2015)
	Lack of self-regulated learning skill	• Use reflective writing exercise to foster students' awareness and reflection of self-regulated learning use (Pérez-Sanagustín et al., 2021). • Embed prompts (i.e. questions concerning self-regulated learning) into video lectures (Moos & Bonde, 2016). • Use recommenders to suggest appropriate self-regulated learning skills (Bodily et al., 2018)
Not engaged with synchronous online lesson	Zoom fatigue	• Avoid multi-tasking by closing all other browsers (Ngien & Hogan, 2022). • Reduce the tendency to gaze at your own face by using the function 'Hide Self View' on Zoom (Fossilen & West Duffy, 2020). • Occasionally look away from the computer completely for a few seconds (Fossilen & West Duffy, 2020). • Schedule breaks between virtual meetings (Riedl, 2022). • Create a straight line from one's face to the person on the screen by propping up the computer screen (Walker, 2020)
	Refusal to switch on webcam	• Explicitly encourage students to show their faces on webcams but provide some leeway to switch off for those who are shy/uncomfortable (Maimaiti et al., 2021). • Individually reach out to students who regularly do not turn on their cameras and ask whether there is anything one can do to help them feel more comfortable with turning it on (Castelli & Sarvary, 2021)

TABLE 1 (Continued)

Key challenges	Contributing factors	Possible strategy
	Lack of rapport with instructor/peers	• Instructor greets and converses with students before class (Jia et al., 2023). • Instructor remains online after the class ends to allow time for questions and informal interaction (Jia et al., 2023). • Use a chatbot to foster a sense of social presence in the online environment (Hew et al., 2023)
	Difficult to maintain concentration during the synchronous online lesson	• Use a digital pen to write (Guo et al., 2014). • Use more gamified quizzes (e.g. Quizizz, a website for gamified quiz creation) during synchronous class (Jia et al., 2023). • Use more than one instructor if possible (Jia et al., 2023)
	Bored with group activity/presentation	• Not more than 3 online group activities in each online lesson. (Maimaiti et al., 2021). • Shorten the duration of students' group presentations in synchronous online learning to 20 min (Jia et al., 2023)

effects of gamification on students' outcomes (e.g. behavioural engagement, emotional engagement, cognitive engagement and learning performance) in online learning activities using multiple data collection methods. We have published more than 20 articles, including systematic reviews of the gamification literature. Here, we briefly discuss two main findings.

4.2 | Gamification can improve student learning performance but its effects on student intrinsic motivation remain unclear

We found an overall positive impact of gamification on student academic achievement with small to medium effect sizes (e.g. Bai et al., 2020; Huang et al., 2020; Sailer & Homner, 2020). However, the effects of gamification on student intrinsic motivation in learning is unclear. Intrinsic motivation refers to people doing an activity because they are interested in the particular activity and enjoy what they are doing, rather than due to some external factors (Cameron & Pierce, 2002). Intrinsically motivated students are more likely to persist in their learning and are more willing to voluntarily attempt different challenges (Deci & Ryan, 2004). Empirical studies have reported mixed results, with some gamification studies reporting positive effects on intrinsic motivation, but others finding no effects or even negative effects (Hanus & Fox, 2015; Jones et al., 2022; Mekler et al., 2017; Tasadduq et al., 2021).

Although several recent meta-analyses have reported that gamification positively affects students' motivation (e.g. Mula-Falcón et al., 2022; Ritzhaupt et al., 2021; Sailer & Homner, 2020), a closer examination of these published meta-analyses reveals that they did not explicitly explain whether they focused on intrinsic or extrinsic motivation or their motivation outcomes also included other constructs. For example, although Ritzhaupt et al. (2021) reported a positive and significant effect size for the influence of gamification on students' affective outcomes, the affective outcomes included not only motivation but also learner self-efficacy, perceived learning, perceived ease of use and attitude.

Future work should therefore focus on examining the effect of gamification on student intrinsic motivation. A recent study found that using tangible rewards linked to some standard of performance in gamified learning can significantly increase students' intrinsic motivation, behavioural engagement, cognitive engagement and learning performance compared to using merely intangible rewards (Xiao & Hew, 2023b). Further studies can be done to validate this finding in other classes. Additionally, there is a crucial need to investigate the long-term effects of gamification on student motivation, engagement and learning performance. We really do not know the possible effects of long-term use of gamification since most published studies had a short duration, usually about one semester. More longitudinal studies of at least 1 year should be carried out to examine how the effects of gamification on student academic achievement and intrinsic motivation may change over time.

4.3 | 'One-size-fits-all' gamification may not be effective for all students

Many gamification designs currently utilise a 'one-size-fits-all' (OSFA) gamification approach which assumes that users are a homogenous group, reacting similarly to different game elements. However, the OSFA approach is unlikely to optimise the effects of gamification since each user has different expectations and needs. In other words, each user may only be interested in certain game elements and no other elements. Against this backdrop, personalised gamification that optimises students' motivation based on their user characteristics is a promising direction to investigate.

Previous attempts to personalise gamification typically categorise users into different player types. A myriad of player type frameworks or models were proposed, including Bartle's player taxonomy (Bartle, 1996), BrainHex framework (Bateman et al., 2011) and the Hexad model (Diamond et al., 2015). For example, Bartle proposed that users can be grouped into four player types: achievers, explorers, socializers and killers. However, there are many overlaps between the different conceptualisations of player types. This raises an important question—which specific player type framework or model should we then employ in personalised gamification? Additionally, some scholars claim that there is no absolute type of characteristic for players and that players usually have all types of characteristics; different people have some of these characteristics more and less (Hajarian et al., 2019). If this is the case, how then should we best classify the users? More importantly, most previous studies assumed that users' player type attributes are static; that these attributes do not change over time. However, this may not be true. Players do not necessarily belong to only one type because they may change from one player type to another player type (Serpa, 2020). If this is the case, then the use of 'static' personalisation will not be accurate. A recent paper argued for the need for automising personalised gamification through machine learning methods (Xiao & Hew, 2023a). These are some issues that future research on personalised gamification should examine.

5 | PROMOTING SELF-REGULATION SKILLS

Over the past several years, numerous attempts have been conducted to promote students' self-regulated learning skills in online learning activities. One of the most commonly used strategies is prompts (e.g. Moos & Bonde, 2016; Shyr & Chen, 2018; van Alten et al., 2020a, 2020b). The prompts may be displayed as questions referring to each learning phase of self-regulated learning (e.g. Do you need to adjust how you are learning) embedded in video lectures (Moos & Bonde, 2016). Students have to answer the questions in order to continue watching videos. In other studies, the prompts were not embedded in the video lectures but stored in a database (e.g. Shyr & Chen, 2018). Students can access the prompts of their own volition to help them understand the learning task better and regulate their learning. Examples of the prompts include 'please describe the goals and sub-goals for this task' and 'what have you learned from performing this task?' (Shyr & Chen, 2018). Answering the prompt questions can help raise students' awareness of self-regulated learning. It is worthwhile to note that most prior prompt studies did not tailor the prompts according to different levels of students' self-regulated learning skills.

Other studies have examined the use of recommendations to foster students' self-regulated learning skills (Du & Hew, 2022). A typical recommendation setup would entail presenting participants with some follow-up self-regulated learning strategies based on some prior user generated outputs (e.g. user self-reported survey data and user online behaviour). For example, Bodily et al. (2018) described a metacognitive skills recommender which requires students to first self report their level of knowledge awareness by rating their confidence on the quiz questions where students who answer a question correctly with high confidence will have their knowledge awareness scores increased, while students who answer a question wrongly with high confidence will have their knowledge scores reduced. Next, based on the knowledge awareness score, the recommender will suggest certain actions for students to increase the score. One benefit of using recommendations is that they can provide students with tailored feedback based on students' prior self-regulated learning abilities. By taking students' different levels of self-regulated learning skills into consideration, recommendations can therefore highlight more specific strategies that students need to improve. Despite the benefits of prompts and recommendations, several limitations or gaps exist in the literature. Here, we highlight three gaps.

5.1 | Unclear evidence regarding the use of prompts

The findings concerning the effects of prompts on students' self-regulated learning skills are mixed. On the one hand, some studies found the use of prompts leads to better learning outcomes and students performing or reporting more self-regulated learning activities compared to those who did not receive the prompts (e.g. Moos & Bonde, 2016; Shyr & Chen, 2018). On the other hand, other studies reported no effects of the prompts on learning outcomes (e.g. van Alten et al., 2020a) or on self-regulated learning (e.g. van Alten et al., 2020a, 2020b). Possible reasons for the mixed findings include students' different educational levels and prior self-regulated learning skills, using mandatory prompts (e.g. prompts that students have to answer before they can continue watching the video) versus optional prompts (i.e. prompts that students can access of their own volition) and students' lack of motivation to engage in self-regulated learning activities. Future research should examine these possible reasons in greater depth as well as uncover other contributing factors.

5.2 | Few studies explicitly examined the effects of recommendations on students' self-regulated learning skills or learning performance

A recent review on recommenders found that only three out of 20 studies explicitly examined the effects of recommenders on students' self-regulated learning skills or learning performance (Du & Hew, 2022). These studies employed self-report instruments such as surveys, log data and/or knowledge tests. More studies are therefore urgently needed in the future to examine this issue.

5.3 | (Un)trustworthiness of self-reported tools to measure self-regulated learning?

The most common instrument for measuring students' self-regulated learning is the self-report tool (Du et al., 2023) such as the questionnaire (e.g. Motivated Learning Strategies Questionnaire), interviews, think aloud and learning diaries. However, many studies have criticised the limitations of self-report tool due to it being subject to student providing socially desired responses, relying on student memory which may be faulty or limited and the inability of self-report tool to capture real-time changes of student self-regulated learning during an online activity (Du et al., 2023). To address these limitations, an increasing number of studies have employed the use of online trace data.

Simply put, online trace data can be defined as users' clickstream record such as the links they clicked on when they interact with a system (e.g. a website). Trace data provides trails of user's online behaviours when they engage in digital environments (Lampe, 2013). Compared to self-report tools such as questionnaires, trace data do not bother users with questions and can unobtrusively and automatically record users' real-time online behaviour (Choi et al., 2023). Despite the potential benefits of online trace data to measure students' online self-regulated learning, several issues need further investigation. First, how valid are the online trace data in representing students' self-regulated learning activities or processes? A recent article describes in detail some of the online traces that have been used in previous studies to represent self-regulated learning processes (Du et al., 2023). More studies are needed to further validate the mapping between the online trace data and the self-regulated learning processes. Second, should we trust online trace data only?

6 | REDUCING THE SENSE OF ISOLATION THROUGH THE USE OF CHATBOTS

In the past several years, there is increasing interest in the use of chatbots in education. Chatbots can potentially support students in teaching-oriented and service-oriented tasks (Okonkwo & Ade-Ibijola, 2021; Pérez et al., 2020). The former type of chatbots focus on providing students learning materials, assessment and instant feedback in specific topics. The main purpose of these teaching-oriented chatbots is to teach students knowledge (Wollny et al., 2021) like a human teaching assistant would (Pérez et al., 2020). The service-oriented chatbots offer administrative help to simplify students' daily life (Wollny et al., 2021), such as answering students' frequent questions about course enrolment and registration (Okonkwo & Ade-Ibijola, 2021). Compared to other communication ways in education, such as emails, chatbots can provide real-time interaction with individual students (Okonkwo & Ade-Ibijola, 2021), which can help reduce students' feeling of loneliness or lack of rapport with peers and teachers during online learning.

In the following section, we report an unpublished study detailing how we designed a rule-based chatbot to promote a sense of social presence. The sense of social presence can help reduce feelings of isolation in online learning (Hew et al., 2023). We designed the rule-based chatbot based on the indicators of social presence as adopted from Garrison (2011, pp. 38–39). We also assessed students' perceived social presence of chatbot activity. Our study was guided by the following research questions: (a) How do students perceive the chatbot in terms of their social presence? (b) What are the students' suggestions for designing social interaction between the chatbot and students?

6.1 | Social presence as the theoretical framework in chatbot design

Social presence comprises three categories: interpersonal communication, open communication and cohesive communication (Garrison, 2011). Table 2 presents the chatbot conversation design based on these social presence categories. First, interpersonal communication establishes an academic climate that is conducive to open and purposeful interaction while fostering a sense of belonging within the online learning community. Indicators of interpersonal communication include affective expressions, such as repetitive punctuation and emoticons. Citing an example, the expression of understanding 'I see' was added to the chatbot's response to express different feelings. The chatbot could reply to students with 'I see' and the repeating dots '…' to show that it is trying to understand the students' answers or still processing the conversation. It could also respond with

TABLE 2 Chatbot conversation design using social presence indicators (adopted from Garrison, 2011, pp. 38–39).

Category	Indicators	Chatbot conversation design
Interpersonal communication	Affective expression using emotions such as emojis and repetitious punctuation	I see! 😉
		Ah I see…
Open communication	Continuing a thread	I'm curious why you think so. Can you explain a bit?
	Asking moderating questions	Anything else you want to add on?
	Expressing appreciation	Great!
Cohesive communication	Using vocatives to address participants' names	No worries, [student's name]!
	Addressing the group identity using inclusive pronouns 'we, us, our'	Before we start a new learning journey…
		Let's move on.
	Using phatic expressions such as greetings and closures	Hi!
		See you soon!

'I see' followed by a smiley emoji to express that it has already understood the previous conversation and is in a positive mood.

Second, open communication refers to interacting with others in a mutual and respectful manner. This can be developed by responding to others, asking further questions to moderate the inquiry and expressing appreciation. The interactive nature of the chatbot allowed it to respond to students immediately and ask follow-up questions to continue the conversation. Appreciations (e.g. 'Great!') were added to the chatbot's responses to create an encouraging interaction.

Third, cohesive communication maintains group cohesion in online learning environments where students are separated in time and space. It usually begins with activities such as addressing others by name and using inclusive pronouns (e.g. 'we') to encourage association with other participants. Additional indicators include phatic expressions, such as greetings and closings. The chatbot stored students' names and addressed their names during the conversation. It could greet students with 'Hi!' at the beginning of the conversation. After the learning activity, it ended the conversation with 'See you soon!'

We developed the chatbot using Google Dialogflow, a visual chatbot builder. The chatbot was then integrated with the Moodle learning management system (LMS), which was used as a platform for the instructor to upload course materials and discuss with the students asynchronously. Students could conveniently access and interact with the chatbot by clicking on a tab within the LMS activity page.

6.2 | Participants

Participants were 25 students enroled in an education research course at the Faculty of Education at the University of Hong Kong. The course was delivered using a fully online learning model over a period of 10 weeks. During each week, the participants attended an online video-conferencing lecture and completed asynchronous individual online activities outside of class. The authors' university granted ethical approval to conduct the study. All participants provided informed consent.

The chatbot served as a virtual tutor to interact with students individually before the first online lecture. The chatbot in this study was able to discuss with students about their previous research experiences, introduce the course schedule and weekly learning topics and allow students to share their expectations for the new course while providing feedback and suggestions (see Figure 2 for an example).

6.3 | Data collection and analysis

In this study, we collected and analysed both quantitative and qualitative data. In the first week, students were encouraged to interact with the chatbot. In the second week, they were invited to complete an online survey consisting of a social presence questionnaire on a 5-point Likert scale (1 for strongly disagree and 5 for strongly agree) and two open-ended questions.

We used all nine items from the social presence scale of the Community of Inquiry framework questionnaire (Arbaugh et al., 2008). We revised the phrase ‘other course participants’ in the original scale to ‘chatbot’ because the chatbot was employed as the online participant. An example of the social presence items was ‘I felt comfortable interacting with the chatbot’. The Cronbach's alpha was 0.936 for the social presence scale.

The two open-ended questions were ‘To what extent do you think the chatbot engaged you?’ and ‘To what extent can the interaction between you and the chatbot be improved?' We used the two questions to obtain possible explanations for students' perceived social presence and their suggestions for shaping the future interaction between chatbot and students.

We received 25 responses from the participants (100% response rate). Student responses to the open-ended questions were analysed using thematic analysis (Braun & Clarke, 2006). Two independent coders identified themes by reading each sentence in the students' responses and then

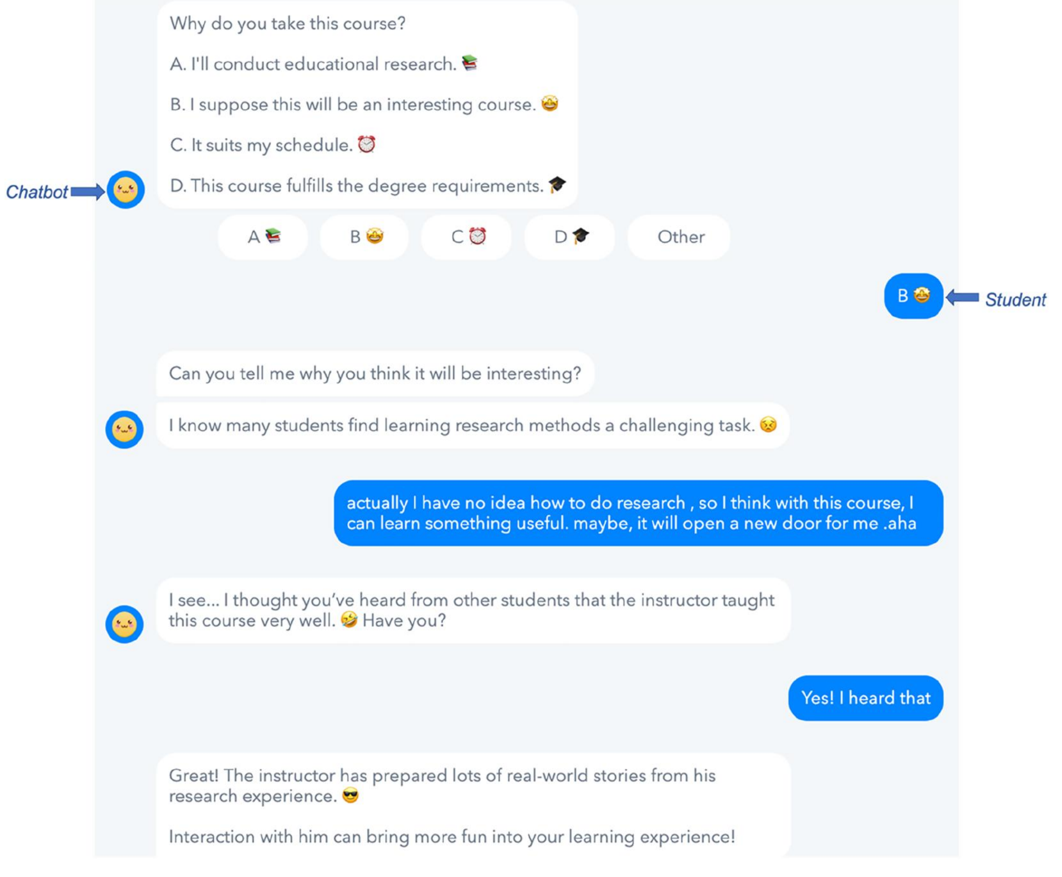

FIGURE 2 An example of chatbot–student conversation.

comparing the themes to each other. A 92% inter-rater agreement was achieved with discrepancies resolved through careful discussion.

We used the results of the social presence scale and the first open-ended question to answer the first research question in terms of students' perceived social presence. The results of the second open-ended question were used to answer the second research question regarding students' suggestions for designing social interaction of the chatbot.

6.4 | Results

6.4.1 | Students' perceived social presence

The descriptive statistical analysis of the students' social presence scale revealed that students ($N = 25$) perceived a high level of social presence for the chatbot ($M = 4.34$, $SD = 0.62$), with all item means exceeding 4 (scale of 'agree'). For example, students agreed that they gained a sense of belonging in the online learning environment by getting to know the chatbot. They found it comfortable to converse with the chatbot, including expressing disagreement with it, suggesting a facilitated trust relationship between the chatbot and the students. They also agreed that the chatbot could acknowledge their opinions and help them develop a sense of collaboration. Table 3 presents all descriptive results of the social presence scale.

We further analysed the first open-ended question and identified three design elements of the chatbot that promoted students' perceived social presence in online learning. Each element is explained as follows.

Course-related interaction

Although our original intent with this chatbot was to facilitate social interaction between the students and the chatbot, most of them ($n = 17$) emphasised the course-related interaction. By providing 'specific feedback on student learning and useful advice on how to complete assignments' (Student E), the chatbot became an important resource for students to clarify doubts and 'deepen their understanding of the new course' (Student P). Therefore, the chatbot helped 'alleviate

TABLE 3 Students' perceived social presence of the chatbot.

Scale	Items	Mean (SD)
Social presence ($N = 25$)	1. Getting to know the chatbot gave me a sense of belonging in this course	4.36 (0.86)
	2. I was able to form distinct impressions of the chatbot	4.28 (0.79)
	3. Online or web-based communication with the chatbot is an excellent medium for social interaction	4.28 (0.84)
	4. I felt comfortable conversing through the online medium	4.56 (0.65)
	5. I felt comfortable participating in the course discussions	4.44 (0.65)
	6. I felt comfortable interacting with the chatbot	4.48 (0.77)
	7. I felt comfortable disagreeing with the chatbot while still maintaining a sense of trust	4.16 (0.85)
	8. I felt that my point of view was acknowledged by the chatbot	4.20 (0.82)
	9. Online discussions help me to develop a sense of collaboration	4.28 (0.79)

students' anxiety about taking an online course with new classmates and a new instructor' (Student H).

Various expressions of emotions

Students (n = 10) indicated that the design of different emotion expressions made their interaction with the chatbot more interesting and enjoyable. Emojis were frequently mentioned in the students' responses. Using different emojis as visual cues can clarify the intent of chatbot messages. This ensured that the chatbot's responses were easy for students to interpret and reduced the potential for misunderstanding. By conveying emotions in a human-like manner, the chatbot helped promote a 'relaxed interaction' (Student H), like 'chatting with a friend' (Student M).

Tone of the chatbot

Some students (n = 4) reported that the chatbot's tone was 'encouraging, patient, polite and gentle'. By using such a tone, the chatbot fostered a sense of trust and respect and made students feel valued and appreciated. This can help boost their confidence and motivate them to actively participate in online discussions. Student I, for example, appreciated the opportunity to interact with the chatbot because she is usually reluctant to talk to people in public. In addition, this chatbot provided a safe environment for students to 'easily express my thoughts' (Student I) without fear of being criticised or ridiculed. For example, the chatbot encouraged students even if they had expressed that 'I am not yet clear about my expectations' (Student S).

6.4.2 | Suggestions for improving social interaction

Student-driven interaction

This chatbot was designed to drive student interaction and focused on specific areas (e.g. course information and students' research background). Students reported the limited topics of conversation and their expectation of 'having the opportunity to ask questions' (Student S).

Continuous use of the chatbot

Given the short period of interaction with the chatbot in the first week, students suggested using it continuously to provide support and encouragement. For example, the chatbot can be 'updated with the weekly lectures and learning materials for the rest of the semester' (Student I) to reduce students' sense of isolation over a longer period of time.

6.5 | Lessons learned and suggestions for future research

The results of social presence scale indicated students' positive perceptions of their social interaction with the chatbot. Students gained a sense of belonging in the online learning environment through their interactions with the chatbot. The appropriate tone of the chatbot created a trustful and respectful communication environment. The chatbot's ability to acknowledge students' opinions facilitated a sense of collaboration, enhancing their perceived social presence in the online setting. The instructor of this fully online course encouraged all students to interact with the chatbot before they met virtually in the first online lecture. Thus, the chatbot served as an icebreaker to introduce the online course to the students in a social interaction manner. Implementing icebreaking activities can help reduce perceived distance in online learning environments (Dixon et al., 2006) and create a supportive and friendly climate (Felani, 2022). Teachers can consider using a chatbot icebreaking activity to facilitate and accelerate students' social bonds with other participants in the online learning community.

Moreover, software agents displaying social cues (e.g. language use and emotions) can also trigger humans' social reactions (Fogg, 2003). Aligned with the participants' recommendation to use chatbots continuously, another possible implication can be using chatbots to model the various indicators of social presence throughout students' entire online learning process. This, in turn, can help activate students' spontaneous social interactions with peers and instructors over the long term, such as initiating discussions and asking thought-provoking questions in an encouraging and relaxed climate.

In addition, students in this study emphasised that the course-related interaction helped reduce their anxiety about starting a new course in a fully online setting. This finding is consistent with Song et al. (2017) who reported that content-related and quality interaction between students and chatbot enhanced the online learning experience. Garrison (2011) also highlighted that social presence does not simply serve social purposes but enables meaningful discourse among online participants. Therefore, teachers need to be aware of the pedagogical purposes of student–chatbot interaction when using chatbots in practice.

Perhaps the biggest direction for future research concerning chatbots at this moment is the potential of using generative AI in education. Typically, chatbots can be classified as either rule-based or AI-based. Rule-based chatbots recognise user queries based on some predefined rules, resulting in accurate responses. AI-based chatbots use machine learning algorithms to generate responses based on previous data and continuously learn from and improve previous models (Maroengsit et al., 2019). The chatbot that we created based on the social presence indicators (as described in an earlier section) was a rule-based chatbot. We chose a rule-based chatbot because it is easier for teachers to create and can give correct responses compared to AI-based chatbots which can sometimes give contradictory answers, leading to confusion or misleading information (Iku-Silan et al., 2023).

Recently, generative AI, which is a type of AI based on large language models that can autonomously learn from data and generate new content, has been developed and taken the world by storm (Peres et al., 2023). Although there are present concerns regarding generative AI such as it being prone to 'hallucinations', a recent article by Morgan (2023) predicts that generative AI's ability to create content across text, code, images and video to improve exponentially through 2030 by producing better outputs than human workers. Rather than using generative AI to merely create content such as producing better papers than human writers, one possible future research direction is to explore using generative AI to project social presence to online participants.

7 | CONCLUSION

In this article, we discussed a perennial issue that continues to plague online learning—the lack of student engagement. We describe three major challenges that can cause student disengagement: students being more easily distracted, students lacking self-regulation skills and students feeling isolated. We then discuss three possible strategies to address these challenges: promoting active learning using the online flipped classroom model, promoting self-regulation skills and reducing the sense of isolation through the use of chatbots. We also discuss some of the unresolved issues pertaining to each strategy and suggest several fruitful directions, including the use of personalised gamification, using online trace data to measure students' self-regulated learning skills and employing generative AI to foster a sense of online social presence. It is hoped that the suggestions for future research can spur greater understanding and efforts in enhancing student engagement in fully online learning environments.

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CONFLICT OF INTEREST STATEMENT

We have no known conflict of interest to disclose.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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