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Digital Technology Use in High School Classes: Linking Types of Access and Student Engagement

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Abstract

Education in high schools is evolving with the widespread adoption of digital technologies. However, digitalization is a complex process that still challenges teachers while they aim to implement technologies to meet learners' needs and preferences. Further, the digital divide remains an important issue that should be addressed to provide learners with meaningful technology learning experiences that can engage and motivate them. To address these issues, the current study uses a qualitative descriptive approach and relies on semi-structured interviews with 17 high school teachers from different schools in Québec to examine the uses of digital technologies that address the needs of learners from the perspective of diverse high school teachers. Results revealed the existence of digital inequalities that still impact student engagement and the capacity of teachers to address learner needs. The study findings also emphasize the importance of providing teachers and students with adequate resources and training for the successful deployment of digital technology in the classroom.

Keywords: secondary education, digital technologies, student engagement, student learning, diverse needs

Introduction

The COVID-19 pandemic and the resulting confinement measures have accelerated the process of digitalization in high schools (González-Betancor et al., 2021; Kalenda et al., 2022). In Quebec, schools are increasingly incorporating new technologies into their classroom activities and providing teachers and students with the necessary ICT (information and communication technology) resources (Académie de la Transformation Numérique, 2021). More and more educational institutions are adopting online learning platforms, which use internet-based technologies to provide automated feedback for students and streamline assessment processes for teachers (Cabellos et al., 2023). The confinement has also fostered the use of both asynchronous and synchronous communication platforms (Atmojo & Nugroho, 2020; Devitt et al., 2020).

Although the pandemic has provided an opportunity for some to experiment with innovative digital instructional approaches (Reynolds et al., 2022), such processes have been hampered by the exclusion of disadvantaged learners due to digital inequalities in four types of access: motivation, physical access, digital skills, and different usage (Shamir-Inbal & Blau, 2021; van Dijk, 2020). The pandemic has worsened the problem of digital divide by widening the gap between students regarding physical access, skills, and usage (Ma & Cheng, 2022). In its latest report, the Académie de la Transformation Numérique (2023) indicated that 90% of young Quebecers aged between 6- and 17-years old use electronic devices, whether at home or elsewhere. However, the fact that watching videos on the Internet is their most popular activity (67%) followed by online games (64%) suggests that their willingness to embrace technologies for learning gains is insufficient.

Digital technologies in high schools are often teacher-centered and are used as content delivery tools without meaningful and engaging learning activities (Jung et al., 2020; Reich, 2019; Voogt et al., 2018). Cabellos et al. (2023) argued that the widespread use of technologies has not helped to make learning student-centered but was teacher-driven and primarily aimed at the transmission and evaluation of the learning content. In fact, student motivation and engagement have been heavily impacted by changes in teacher instructional practices during the pandemic, exacerbating the pre-existing concerns about students' low school motivation, particularly in high schools (Cai et al., 2022; Daniels et al., 2021). Kim et al. (2021) confirmed the existence of three profiles in school digital inclusion (SDI) across the 27 countries that participated in the 2018 Programme for International Student Assessment (PISA) of low, medium, and high. High SDI schools (21.1%) had sufficient digital devices, better support to effectively use technology, and higher levels of student and teacher digital literacy, suggesting that teachers are the key to meaningful integration of technology into classrooms and to adequate digital inclusion of all students. Therefore, student dispositions towards digital technology use in classes are not the same, so their needs or preferences must be considered to reduce digital disparities in education (Magnan et al., 2021; Sahlberg, 2021).

Most of the empirical literature on the uses and potential benefits of digital technology in high schools still consider students as a homogenous group regardless of their diversity (Voogt et al., 2018). To our knowledge, except for a few studies focusing very specifically on students with disabilities (e.g., Roberts-Yates & Silvera-Tawil, 2019; Shaheen & Lazar, 2018; Zilz & Pang, 2021), the current studies on the uses of technologies in high school classes do not take into account students' particular needs or preferences resulting from inequalities of access, skills,

and use when it comes to learning and adaptation difficulties. In the latest *Handbook of Information Technology in Primary and Secondary Education*, Voogt et al. (2018) emphasized the need to carry out more research to better understand and explain which uses of digital technology support the learning and engagement of all students. The current study aims to provide a more nuanced comprehension of the digital uses that engage and support the needs of all high school students.

Theoretical Framework and Literature Review

Digital Technology and Learner Engagement

Previous research showed that technology use influence student engagement as well as academic performance (Gunuc, 2023; Park & Weng, 2020). For instance, Aidoo et al. (2022) demonstrated that the flipped classroom model created valuable opportunities to free up class time for student collaboration, fostering deeper engagement with the learning content. The extra time enabled teachers to actively assess student understanding and incorporate problem-solving tasks into classroom activities. Additionally, the integration of educational technologies in this model enhanced student participation and engagement, ultimately leading to improved comprehension. In a study conducted by Wang and Wang (2023), the researchers examined the relationship between educational technology uses, student engagement, and student academic performance across five countries: Finland, Hong Kong, South Korea, Singapore, and the United States. The results showed that school educational technology uses are correlated with curriculum-based engagement at the student level and non-curricular engagement at both school and student levels. However, the misuse of educational ICT resources by students can create a negative atmosphere that undermines overall student engagement. Furthermore, a significant portion of students struggle to effectively select and use these resources, with their digital literacy barely meeting minimum standards. Similarly, Chiappe et al. (2023) concluded that learning strategies embedded in digital technologies, which foster interaction, collaboration, and activities tailored to students' needs, can generate greater cognitive engagement and promote critical thinking. They emphasized that student participation is shaped by their interaction with the learning environment, which enhances interactive processes. Crucially, it is the purposeful use of ICTs that facilitates bidirectional communication—by enabling timely and effective feedback mechanisms, students can instantly assess the impact of their interventions during learning activities. This real-time feedback, enabled through digital tools, strengthens the learning process by making communication more dynamic and responsive. Clearly, given the widespread use of digital technology and the emphasis on developing digital skills, it is essential to understand issues related to technology access, skills, and use by young learners. The impact on student learning is not driven by the mere presence of digital technology, but by how it is employed to actively promote student engagement. Thus, the question is not simply whether digital technology is engaging, but rather how the types of access and the ways in which it is used influence student engagement and learning outcomes.

Digital Divide

Digital transformation has been implemented in our societies in the last decade at an accelerated pace. However, according to several recent studies, inequities have been reported in students' digital device and networking resources, digital literacies, and uses in classrooms (Reynolds et al., 2022). In addition, high school teachers, and especially those serving lower income communities, described significant challenges meeting the educational needs of young

learners—highlighting evident gaps in digital equity for families with working parents who are unable to provide the required instructional support (Li & Lalani, 2020).

In this scenario of accelerated digitalization, the concept of the digital gap has made a comeback, becoming a pressing concern in recent years (Medina et al., 2022). Defined as "a division between people who have access and use of digital media and those who do not" (van Dijk, 2020, p. 13), the digital divide involves four types of access: motivational access, physical access, skills access, and usage access. *Motivational access* refers to the mental readiness of an individual to have and use digital technologies. *Physical access* is related to the possession of digital devices, network connection or permission to use them, and their content. *Skills access* refers to the possession of operational skills (operate a computer, network, and software), informational skills (search, select, process, and assess information in computer and network resources), and strategic skills (use computer and network sources to reach specific goals). And, lastly, *usage access* corresponds to one's ability to take advantage of digital technology to serve one's interests and personal or professional development.

Learner Engagement

Learner engagement is a multidimensional concept, encompassing behavioral, socio-affective, and cognitive aspects (Archambault et al., 2019). *Behavioral engagement* relates to positive student behaviors, such as following rules, attention, and involvement in learning and academic tasks (Guo et al., 2015). *Socio-affective engagement* refers to affective reactions related to learning, such as interest, joy, valuing learning, as well as relatedness and positive relationships (Ng et al., 2018). *Cognitive engagement* is learners' psychological investment in class activities and the use of learning and metacognitive strategies (Reschly et al., 2014).

Previous research showed that technology use affects student engagement. Tay et al. (2021) sought to document how teachers design and implement of teaching and learning experiences, their reflections of student engagement, and gaps in understanding so that teachers continue to improve the use of technology for meaningful learning and student engagement. The study findings revealed that student engagement and learning are shaped not only by technological availability and accessibility, but also by teachers' choice of content and how it is taught. It is the way these elements are used to support student learning engagement that ultimately shapes the selection of tools, rather than simply adopting the latest technologies. Having access to technological hardware is important, but it is equally fundamental for students to have the technological know-how to use the hardware and software for effective learning. A similar point was made by Gopinathan et al. (2022), who argued that with the combination of suitable infrastructure, access to technology, and guidance, students' willingness to engage with learning can be achieved.

Another study conducted in the context of the COVID-19 pandemic showed that the availability of technologies, technical support, and reliable internet connection is positively correlated with higher student engagement (Khlaif et al., 2021). However, promoting student engagement in class using digital technology involves more than well-planned teaching strategies and access to technology. Digital technologies on their own are not sufficient for student engagement; it is rather the way in which teachers mobilize them to address the needs of learners that will enhance their engagement.

Engagement and Satisfaction of Learner Needs with Digital Technologies

Technologies can enhance students' motivation, engagement, as well as their learning (Budnyk & Kotyk, 2020; Krath et al., 2021; Reeves et al., 2021). However, the accelerated expansion of technology over the last three decades and its gradual integration into high school classrooms has raised questions about how teaching and learning practices can be enhanced in diverse classrooms (Ashraf et al., 2021). While today's classrooms are full of students from a variety of backgrounds, teachers are constantly faced with the challenge of improving instruction to meet the learning needs of their learners (Diallo & Maizonniaux, 2016).

Student engagement has been mostly seen as an outcome of satisfying their needs for autonomy, competence, and relatedness (Hsu et al., 2019; Reeve & Cheon, 2021). A better understanding of these needs on both a broad and in-depth level allows teachers to measure learners' current learning level, set goals for the student, coordinate services, and evaluate intervention effectiveness (Griffiths et al., 2022). In the context of digital learning, self-determination theory (SDT; Ryan & Deci, 2017) can accordingly explain the effects of needs-based support on student motivation, engagement, and learning.

Self-Determination Theory

Self-determination theory (SDT) provides a comprehensive theoretical framework that helps clarifying how the concept of learner engagement works (Barkley & Major, 2020). In fact, SDT theorists argue that each person needs to satisfy basic needs for autonomy, competence, and relatedness. *Autonomy* involves having the ability to choose, regulating one's own actions, and acting in accordance with one's values. *Competence* refers to the experience of mastery and being effective in a given task as well as being optimally challenged. Finally, *relatedness* denotes the experience of being connected and a sense of belongingness with others (Ryan & Deci, 2017).

Chiu (2021) examined how the three perceived psychological needs of self-determination theory affect student engagement in online learning. His study revealed that three digital support strategies of autonomy (various resources and allowing choices for learning), involvement (small support groups), and structure (teaching with well-designed digital materials) are likely to motivate students to engage behaviorally, emotionally, cognitively, and academically with technology. Although their study results show a correlation between the three basic needs of learners and their engagement, the circumstances surrounding the COVID-19 pandemic and social isolation may have affected the participants' perceptions. According to the same author, when learners' needs are supported by teachers, they are more willing to engage and make efforts. On the other hand, the study placed much more emphasis on digital support to the detriment of teachers who are essential for effective integration of digital technology in the classroom.

Li and Zhu (2023) conducted a study that examined the effects of technology use on academic achievement with a high school students' sample from 52 countries or economies in the PISA 2018 database. Guided by self-determination theory (Ryan & Deci, 2017), the study conceptualized learners' cognitive-motivational engagement in technology as their perceived autonomy, feeling of competence, and interest. The results revealed that a strong sense of autonomy, competence, and interest in technology use promotes academic success. The authors suggested that young people who have developed such cognitive-motivational

engagement in technology will have a stronger propensity to use digital technology to learn and solve problems in and across formal and informal contexts. However, the researchers admitted that many schools lacked the capacity to unleash the full potential of technology to change their ways of teaching and used it only for a limited range of pedagogical purposes, with no benefit to learning. They recommend that research into effective integration of technology in education is needed.

The Study Problem and Questions

How digital technology addresses students' psychological needs to foster engagement is largely underexplored (Chiu, 2021). Ryan and Deci (2020) highlighted the need for recently further studies grounded in self-determination theory to understand how access to technology can support learner motivation, thereby promoting greater engagement and learning. Therefore, we posit that inequalities in motivation, access, use, and skills must be overcome to take advantage of digital technologies and resources in the classroom. Then digital technology can provide teachers with many opportunities to meet the diverse needs and preferences of learners, thereby improving their learning and engagement (Figure 1). Moreover, further research is still needed to explore teacher practices and the aspects of digital technology use—such as personalized learning, interactive tools, and feedback mechanisms—that are most impactful in addressing student preferences and enhancing engagement in the classroom (Cheah et al., 2023). To our knowledge, much of the existing research is quantitative and has been conducted in higher education, while other educational settings remain largely overlooked (Bond & Bergdahl, 2022; Chiu, 2023).

Figure 1
The Study Theoretical Framework
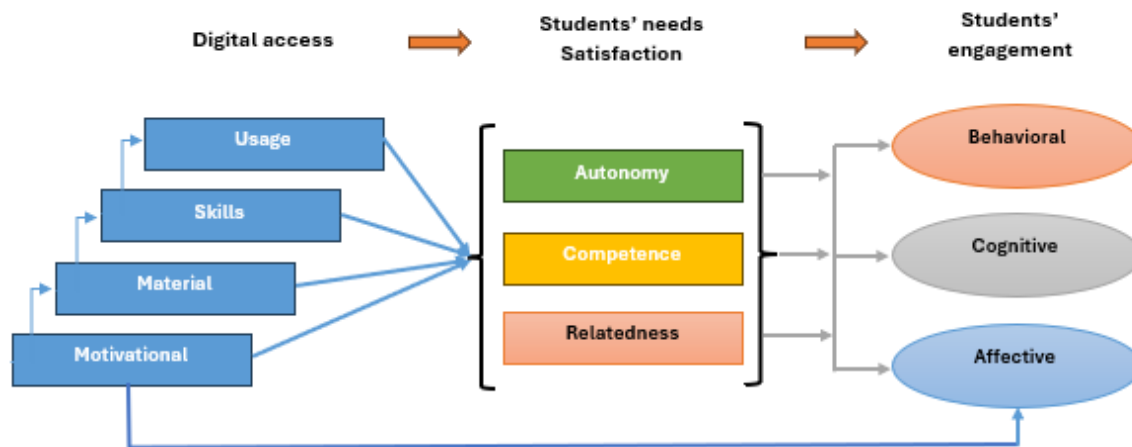
Therefore, guided by the self-determination theory (Ryan & Deci, 2017) and the student engagement model (Archambault et al., 2019), this study examines the uses of digital technologies that engage and address the needs of high school learners, according to diverse high school teachers. The following research questions drive this study:

1. What types of digital access (motivational access, physical access, access to skills, and access to usage) do students have in their classes?

2. To what extent does the use of digital technology in high schools promote the feeling of autonomy, competence, and relatedness?

3. To what extent does the use of digital technology in high schools promote students' behavioral, socio-affective, and cognitive engagement?

Methodology

Participants and Data Collection

This study followed a qualitative approach to explore in-depth data and insights on its topic (Leedy & Ormrod, 2021). Recruitment of participants was carried out through social media, including Facebook, Twitter, and LinkedIn. Posts and advertisements were shared in groups and communities relevant to educators, specifically those focused on teaching practices and technology integration in high school settings. Initial posts were crafted to invite high school teachers from various disciplines to participate in the study. Interested individuals were asked to respond directly to an email with details regarding their teaching experience, subject area, and use of digital technologies in the classroom, ensuring a diverse range of perspectives. To maintain an unbiased selection process, participants were chosen based on a set of predetermined criteria, including their willingness to share experiences and insights related to the use of digital technology in their teaching. Ultimately, seventeen high school teachers from various disciplines and schools in Québec were interviewed, revealing rich and sufficiently detailed data to deliver a comprehensive examination of the phenomenon under study (Maxwell, 2009; Merriam & Tisdell, 2015). Table 1 summarizes the individual characteristics of the participants.

A semi-structured interview method was used to collect data, being among the most common and powerful qualitative methods for exploring the understanding of a phenomenon according to its own actors (Fontana & Frey, 1994). The interview guide (Appendix A) was developed around several themes. The questions in the first theme aimed to describe teachers' uses of digital technology in their high school classes in relation to the teaching environment and the characteristics or difficulties of their students. Teachers were also invited to explain how they address the variability of student needs and preferences in their uses of digital technology to support the learning and engagement of all students, from an inclusive perspective. Another discussed theme concerned the support measures that can be implemented to facilitate learning and engagement with digital technology. Information was also collected on the challenges in considering learners' needs in terms of digital uses. The interview guide was pretested with two teachers to assess its clarity and relevance to the research questions. The feedback gathered was used to make necessary adjustments to the survey and interview protocols before proceeding with the rest of the interviews.

Table 1

Characteristics of the Teachers (N = 17)

Demographic	Participants (%)
Gender	47.1% female, 52.9% male
Public/private school	64.7% public, 35.3% private
Deprivation index of the school teaching context (public)	29.4% (very) advantaged (1 to 3)
	17.6% median (4 to 7)
	17.6% very disadvantaged (8 to 10)
Levels taught	12.4% Secondary 1
	16.7% Secondary 2
	29.2% Secondary 3
	25% Secondary 4
	16.7% Secondary 5
School subjects taught	28.6% French
	19% history
	14.3% mathematics
	14.3% science
	9.5% computer science
	9.5% social science
	4.8% English as a second language
Teaching experience	7.1% 1–5 years
	35.7% 6–10 years
	28.6% 11–20 years
	28.6% > 20 years

The participants did not provide written consent for public sharing of their data. However, the data are available upon request from the corresponding author. The interviews were carried out online between October 2022 and February 2023. All interviews, which lasted approximately one hour each, were video recorded after obtaining the consent of the participants. The data were securely stored on an encrypted, password-protected server. Each participant was assigned a unique identifier to anonymize their data. Access to this data was limited to authorized members of the research team, ensuring confidentiality and adherence to ethical standards. The data will be retained for five years following the study, in accordance with institutional guidelines, after which it will be permanently deleted. All data handling procedures complied with ethical standards and data protection regulations.

Data Analysis

The interviews were fully transcribed, and the transcripts were coded using the MaxQDA software following a general inductive analysis approach (Miles et al., 2020; Thomas, 2006). Based on an in-depth reading of the interview transcripts, a preliminary list of themes was established corresponding to our objectives and our research questions: types of digital uses, support for digital uses, learning and engagement with digital technology, digital technology and diversity of learners, and general challenges linked to digital uses. Keeping in mind that coding in qualitative research is a simultaneous work of identification, comparison, analysis, and interpretation (Rädiker, 2020), the first phase of open coding allowed us to generate codes that describe the participants' words and statements. Then, codes were grouped to form a hierarchy of conceptualizing categories that correspond to the research study. To ensure reliability, the results of the analysis as well as the interpretations and conclusions were subject to inter-rater agreement and discussions among the research team members.

Results and Discussion

What Types of Digital Access do Students Have in Their Classes?

Motivational Access

The first sub-theme showcased students' motivational access to digital technology (Table 2). The use of digital technology elicited positive emotions in learners, such as pleasure and joy. Teachers pointed out that the integration of technologies as a support for learning results in higher investment and engagement from students towards the subject matter because this approach is highly solicited in classrooms, and it promotes their intrinsic motivation. On the other hand, the exclusion of digital components in assignments may have the opposite effect.

Table 2

Motivational Access

Theme	Evidence
Feeling of pleasure	"You don't have to motivate the young learner, he already is. For him, it's a pleasure to use his tech tool" (Tea11_ID5_French).
Interest in digital technology	"Students were very interested by the project [creating a learning video], they found it different […], original to do it like that" (Tea14_ID9_Science).
Motivation	"I see a certain motivation in what they submit. I see the pleasure they had in doing this task [making a survey using Canva" (Tea3_ID3_Social Science).
Efficiency and speed in completing tasks	"It's effective. It makes things faster. It will help them write faster. We can put pictures" (Tea13_ID9_French).
Teachers' reluctance	"Here, we have classes with tablets. There are teachers with whom students have never used them because these teachers are reluctant, they don't like it, they aren't comfortable with" (Tea4_IN2_French).

According to several teachers, students have a heightened sense of competence and efficiency when using digital technologies, which they perceive as faster and more productive tools for accomplishing learning tasks. However, providing meaningful motivational access to technology for learners can be challenging due to the reluctance of some teachers to adopt digital technology in their teaching.

Physical Access

Digital technologies in teaching and learning varied across the different schools. Thanks to massive governmental investments during COVID-19, all participants reported having a reliable Internet connection, a computer for each teacher, and a significant number of digital devices for students. While interviewees highlighted the easy access to physical and material resources, they also explained that conditional access to many educational apps has become easier to obtain. However, memberships to certain platforms were still limited because of security rules or pricing beyond the school budget. There were also misconceptions regarding subsidies intended for digital use (Table 3).

Furthermore, a participant indicated that the widespread use of technology has led to an increase in the use of digital textbooks in schools. They also lamented that these digital resources are still costing students a fortune, and students often forget or lose their passwords or access codes.

Table 3

Physical Access

Theme	Evidence
Material access	"There are digital tools available to students in almost every class. … for example, Chromebooks, a few iPads" (Tea13_ID9_French).
Applications and digital platform access	"The applications […] for example Flipgrid […] We have Kahoot […], interactive games, […] WordQ, Antidote to support learning" (Tea15_ID10_French, Math).
Subsidies intended for digital use	"Unfortunately, this year, we had budget cuts ... for next budgets too. For me, the budgets are not very clear, does it come from the ministry, does it come from the school board" (Tea1_ID2_Science).
Digital textbooks	"Sometimes the access codes in the form of a card glued, but which comes off easily, falls and ends up in the corridor" (Trea1_ID2_Science).

Skills Access

The integration of digital technology into teaching practices has seen a significant increase during the pandemic. All teachers reported being comfortable with operational skills, mainly peripheral device use, operating basic computer systems and applications, browsing websites, etc.

Although they acknowledged having developed a certain command over digital communication skills, teachers also emphasized the need to brush up on other post-pandemic skills to keep up

with the challenges of teaching in the digital era. In this way, they expressed their eagerness to enhance their digital skills, as well as those of their students, with an emphasis on improving their teaching (Table 4). Several interviewees also claimed been trained to develop their content-creating skills and digital creativity, which empowered them to apply their own ideas in digital learning environments.

Regarding learners' skills, almost all respondents keenly claimed that their students know how to operate their smartphones and to browse the Internet, but their digital skills are still limited. Several teachers have reported that while some of their students are tech-savvy, others struggle with basic functions such as writing on Google Docs. The interviewees indicated that the gap in students' digital skills is due to meaningful family support that many lack.

Table 4

Skills Access

Theme	Evidence
Teachers' knowledge of digital skills	"I developed all kinds of skills as a computer technician. When there's a problem, I'm pretty good at being able to resolve it" (Tea10_ID0_French).
Teachers' needs in terms of digital skills	"I am always looking for different training courses, our school board regularly offers us digital training... I keep myself up to date, I work with university interns who often bring me all kinds of other digital novelties to which I have not been familiar with or thought of" (Tea10_ID0_French).
Learners' digital skills	"We often think that students are very good with technology. There are some, yes, but there are others who have difficulties understanding how an application or a platform works" (Tea14_ID9_Science, Computer Science).
Learners' digital skills and family environment	"There are some who have good digital skills because they have had iPads since they were three years old. There are others who are in secondary 1, but the parents did not have an iPad at home" (Tea5_ID5_French).

Usage Access

Three points noted in the Skills Access theme also applied to the Usage Access theme. First, most of the teachers identified that their students could use their smartphones to access the internet, but greater digital skills required further development. Second, many interviewees indicated that some students were very tech-savvy, whereas others had difficulty with online tools such as Google Docs. Third, the participants commented on the belief that the deficiencies in student digital skills were likely a result of meaningful familiar support.

Teachers expressed concerns and identified potential challenges related to using digital technology with their students (Table 5). They consider classroom management when using digital technology as a major challenge that requires regular student monitoring and a sustained control over their activities. In addition, they observed that the needs of students vary considerably, with some requiring constant support and monitoring. Thereby, they actively encourage collaboration and mutual assistance between students when using digital technology

in the classroom. Some teachers mentioned that, due to the diversity of learner skills, those who are more competent voluntarily offer help to those who are experiencing difficulties.

Furthermore, they indicated that although learners spend long hours on their smartphones, the use of these devices often remains passive. A participant highlighted the need to encourage them to use these devices more productively, such as carrying out higher-level cognitive tasks.

Table 5

Usage Access

Theme	Evidence
Class management while using ICTs	"That's for sure the biggest challenge in a computer science class, it's really class management. To have everyone's attention, I offer several possibilities because they don't all go at the same pace" (Tea10_ID0_French).
Supporting learners while using ICTs	"With these students, it's like starting from scratch. I had to show them everything, to say: "OK, go to Discord, click here, enter this information." I am kind of forced to go over all steps quickly with them" (Tea7_ID0_Science).
Collaboration and mutual assistance between students while using ICTs	"If it is really the digital use that does not work, often, there are students who will voluntarily help other students" (Tea7_ID0_Science)
Learners' digital use	"The majority of students use the Internet for entertainment on games or TikTok, and for socializing" (Tea14_ID9_Science, Computer Science).
Encouraging learners for a productive use	"They don't understand that they can simply go to Google and then ask questions. You have a problem, you can ask Google, you can go on YouTube" (Tea1_ID0_History).

The above findings shed light on the types of digital access students experience in their classes. Teachers reported that learners often display positive emotions while engaging with digital technologies, suggesting that these tools can effectively foster motivation and a positive attitude toward active learning (Martínez-Borreguero et al., 2020). Interestingly, while the concept of the digital divide has been widely discussed prior to the pandemic, teachers in this study emphasized the importance of addressing motivational, skills, and usage access as critical factors in student engagement—more so than physical access to technology (Gierdowski, 2019; Jaggars et al., 2021).

Nevertheless, challenges and barriers faced by high school teachers in this study align closely with recent research, namely, the reluctance of several teachers to incorporate new technologies into their pedagogical practices (Ateş & Garzón, 2022). This reluctance underscores the need for ongoing support and investment in developing teachers' digital competencies to ensure they can effectively facilitate students' learning experiences. Moreover, many participants highlighted the urgent necessity of monitoring and equalizing digital skills and resources across high schools. The existing inequalities among students and the obstacles that some teachers encounter in meeting learners' digital educational needs suggest a pressing requirement for increased funding for schools. This funding would enable access to online

learning platforms and adequate training for both students and educators to enhance their digital skills (Sosa Díaz, 2021).

In this context, it is crucial to recognize that mere physical access to technology does not guarantee the development of student digital competencies or spark their interest in learning. Integrating comprehensive professional development for teachers emerges as a pivotal strategy to empower them to adopt innovative teaching methods that effectively cultivate students' digital skills (Areepattamannil & Santos, 2019). Ultimately, a more nuanced understanding of these dynamics can inform future research and practice in educational technology, ensuring that all students can benefit from meaningful and engaging learning experiences.

To What Extent Does the use of Digital Technology in High Schools Promote the Feeling of Autonomy, Competence, and Relatedness?

Autonomy

All participants emphasized that the use of digital technology allows students to be given greater autonomy (Table 6). They also reported that students were particularly motivated when they were given the freedom to make decisions about what they wanted to learn and which modality to use to accomplish their tasks.

Additionally, they added that technology provides greater flexibility with more options for learners both inside and outside of the classroom, making it easier to meet their needs and preferences. However, some interviewees pointed out that catering for all students' needs and preferences is impossible due to lack of time and resources. The absence of an inclusive perspective in pedagogy was also identified as an issue.

Table 6

Autonomy

Theme	Evidence
Learner autonomy	"I find that it facilitates the autonomy of young learners because they can correct themselves, they do not have to wait" (Tea5_ID5_French).
Motivation related to autonomy and decision-making	"The students like that. You know, students, when they suggest their own working tech tools, it's even better" (Tea13_ID9_French).
Choices to meet the needs and preferences of learners	"If I don't have digital technology, there is no diversity, there is no choice for students to know what they prefer to study, they must take their textbook and study. Digital technology brings a huge range of possibilities" (Tea4_ID2_French).
Challenges related to the satisfaction of needs and preferences of learners	"It's time consuming because it takes a long time to build it. We don't necessarily have the time to do everything. Also, I have a lot of students in a class, I still have 36 students in a class" (Tea5_ID5_French).

Competence

Many teachers highlighted the easiness of digital resources with which they can enhance students' competence. The data also reveals that the use of digital technology allows students to learn at their own pace, which helps them understand their learning process and enhance their competence. Accordingly, they can spend more time on difficult topics (accommodating students with learning difficulties) while quickly tackling concepts that they find easier. Technological aids are also provided to certain students with learning difficulties to promote the development of their skills. However, some teachers said this does not necessarily solve all their difficulties.

Additionally, teachers reported feeling more competent in providing feedback using ICTs. They mentioned that technology helps teachers to provide instant and personalized feedback on students' performance in various ways (Table 7).

Table 7

Competence

Theme	Evidence
Students learning at their own pace	"I think students appreciate having a little bit of control over the pace of their learning, which is something that digital technology makes easy" (Tea3_ID3_ Social Science).
Technological aids provided to students with learning difficulties	"WordQ for example, or LexiBar, well, there are a lot of students here who use them" (Tea11_ID5_French).
Teacher feedback	"In terms of feedback, we save a lot of time, efficiency, and students also understand what to do and what they need easily" (Tea6_ID3_History).

Relatedness

All the interviewed teachers observed that digital technologies provide learners with a comfortable and safe space for collaboration and mutual learning. All participants favored the use of pair and group work for their potential benefits for student learning except one teacher who described some issues and challenges related to this approach (Table 8).

Furthermore, based on teachers' observations, the use of digital technology can satisfy learners' relatedness by presenting exercises as games or interactive quizzes. This engages them in a fun and competitive environment while reinforcing their learning and engagement. In addition, the use of digital technology allows teachers to easily plan their classes and share documents ahead of time, which makes it possible to create a secure and supportive learning environment where expectations and procedures are clear.

Teachers reported observing that using digital technologies can promote students' sense of autonomy, competence, and sense of relatedness. Teachers observed that integrating technology into learning environments allows students to take ownership of their educational journeys by enabling them to make choices regarding what and how they learn, both inside and outside the classroom (Zhao & Watterston, 2021). This autonomy is crucial for intrinsic motivation, as students are more likely to engage deeply with content when they feel they have agency over their learning processes. This autonomy is vital for intrinsic motivation, as students

are more likely to engage deeply with content when they feel they have agency over their learning processes. Moreover, the ability to learn at their own pace is linked to students' perceived competence, since they can dedicate more time to challenging concepts while swiftly moving through material they grasp easily (Bergdahl et al., 2020; Siegle & Hook, 2023). This flexible learning environment not only empowers students but also allows teachers to provide targeted support through technological aids for those with learning difficulties.

Table 8

Relatedness

Theme	Evidence
Comfortable environment for collaboration	"Very often, they will help each other in a natural way. They will help each other in using the application if there is one who does not understand" (Tea14_ID9_Science).
Challenges related to group work	"Everyone raises their hands, then everyone speaks at the same time. Sir, it doesn't work. Sir, I'm not there yet. And, there panic reigns" (Tea4_ID2_French).
Interactive games	"They study, then they have a little competition. If I take the example of Quizizz, all students have a link to go and do it" (Tea4_ID2_French).
Sharing documents	"I shared with them an example of what I expected in this situation, that's what working with Classroom and digital tools is about" (Tea3_ID3_ Social Science)

Teachers noted that the efficiency of digital resources facilitates clear communication of objectives and enables instant, personalized feedback, reinforcing students' learning experiences (Moorhouse & Wong, 2022). The aspect of relatedness is also noteworthy, as teachers recognized that digital platforms promote collaboration and peer interaction, creating a supportive community for learners. The incorporation of gamified elements and interactive quizzes fosters engagement and competition, which further solidifies the sense of belonging among students (Deci & Ryan, 2017). However, while these findings highlight the positive impact of digital technology on the psychological needs of students, they also underscore a significant limitation: the teachers' difficulties in adopting inclusive pedagogical practices. The challenges associated with accommodating diverse learning needs and preferences indicate a gap that must be addressed (Chiu, 2023).

To fully realize the potential of digital technology in fostering student engagement, future reforms should prioritize the integration of inclusive teaching strategies within teacher education programs. This includes equipping educators with the skills and knowledge to implement autonomy-supportive and competence-enhancing instructional behaviors. Professional development initiatives focused on ICT integration can empower teachers to design high-quality instructional materials that not only cater to diverse learning needs but also promote student motivation and engagement (Areepattamannil & Santos, 2019). Thus, while the use of digital technology presents significant opportunities for enhancing autonomy, competence, and relatedness, it is imperative that the accompanying pedagogical approaches evolve to support all learners effectively.

To What Extent Does the use of Digital Technology in High Schools Promote Students' Behavioral, Socio-Affective, and Cognitive Engagement?

Behavioral Engagement

Most participants pointed out that their digital practices enhance the behavioral engagement of their learners (Table 9). They argued that the use of technologies, such as digital textbooks and certain learning apps, allowed students to do the work asked rapidly and efficiently. Additionally, the participants reported that teaching with technology encourages active participation and enhances the concentration of the learners. Although some teachers explained that the use of digital technologies helped students with learning difficulties to accomplish their assignments and exams, they highlighted the challenges several of these students still encounter. They also emphasized the lack of suitable resources to address these challenges. These obstacles complicate the work of teachers and make digital learning less beneficial than expected.

Table 9

Behavioral Engagement

Theme	Evidence
Stimulating behavioral engagement	"My students are very engaged, I see it… I also have few students who do not do the work" (Tea6_ID3_History).
Carrying out work faster and more efficiently	"Technology helps find things more quickly, write more quickly, we can put images….It's user-friendly for them to work with" (Tea13_ID9_French).
Active participation	"I just see it in the attitude they have in class, I see them more active" (Tea3_ID3_Social Science).
Challenges related to learning difficulties	"We have many needs and few resources, either time or people. We have students who are ASD, if we can have the educator who supports them, that also helps us to offer them a better experience" (Tea13_ID9_French).

Note: ASD means autism spectrum disorder

Socio-Affective Engagement

According to the interviewees, digital technology plays a fundamental role in enhancing interactions with and among learners, thereby generating a feeling of belonging to the group and promoting students' socio-affective engagement (Table 10). They indicated that students show a particular interest in technologies that incorporate a game-like approach. The participants also reported devoting considerable effort to creating a pleasant learning environment that aims at triggering students' interest and stimulating their socio-emotional engagement. As a counterpoint, some teachers mentioned limitations to socio-affective engagement strategies related to technology use. For instance, a teacher highlighted the difficulty of using digital technologies to foster a high level of energy and enthusiasm in the classroom without interesting and stimulating content for the students.

Table 10

Socio-Affective Engagement

Theme	Evidence
Interactions between learners	"When they are working on a map, they will collaborate. They share the file, they work on it. So, they are obliged to help each other" (Tea16_ID0_History).
Interest for digital technology that uses a game-like approach	"There is also a lot of fun because I use games a lot. ...it engages them" (Tea5_ID5_French).
Creating a pleasant learning environment	"Sometimes I'll play a game, then, if they don't succeed, they fall back to the beginning, they continue. …they did the exercise because it's an escape game" (Tea5_ID5_French).
The combination between the use of digital technology and interesting content	"To say that technology will always improve motivation is not a concern that I have because I find that there are a lot of myths around all that. I would tell you perhaps that I care much more about stimulating content using technology" (Tea2_ID5_English).

Cognitive Engagement

The participants observed that the use of digital technology plays an essential role in stimulating students' cognitive engagement (Table 11). Many teachers used digital tools such as video clips, demonstrations, animations, and multimedia content to facilitate the learners' psychological investment and understanding. They also referred their students to apps, websites, and videos related to the learning content to broaden their learning experiences and deepen their knowledge.

Additionally, most participants pointed out that they provide explicit instructions before implementing any technology to make sure students are more familiar and knowledgeable regarding the use of ICT tools, which enhance their engagement in the activity. They also offer one-on-one support during these activities; this being considered as an effective strategy for fostering students' cognitive engagement. However, some teachers (particularly novices) face certain challenges to stimulate cognitive engagement from all learners, or even to provide the type of teaching and assessment that address their needs and preferences.

The study results reveal that the integration of digital technology significantly enhances students' behavioral, socio-affective, and cognitive engagement. Teachers reported that the incorporation of technologies such as digital textbooks and learning apps promotes not only efficiency in task completion but also active participation and heightened concentration among students (see also Alghamdi et al., 2020; Lacka et al., 2021), This suggests that technology acts as a catalyst for engagement, transforming traditional learning environments into dynamic spaces where students are encouraged to take an active role in their education. Furthermore, the use of game-like approaches and interactive elements has been particularly effective in fostering socio-affective engagement. Participants reported that such strategies create a sense of belonging and enhance interpersonal connections among learners, paralleling findings from Grasse et al., (2021) and Wood (2022). However, the challenges highlighted by some teachers, particularly regarding the necessity of stimulating content to maintain energy and enthusiasm, indicate that the mere presence of technology is not sufficient. It must be paired with compelling and relevant material to fully realize its potential in enhancing student engagement. This underscores the importance of pedagogical design in the successful integration of technology into the classroom.

Table 11

Cognitive Engagement

Theme	Evidence
Variety, discovery activities	"By varying the ways of teaching with technology, it allows us to vary precisely because we don't always teach in this way. So, this sometimes allows us to do more discovery activities. It allows for variation, then it engages them" (Tea12_ID0_Math).
Using ICTs to facilitate cognitive engagement	"I'm going to have some kind of video banks. So often I will leave a QR code and say "here is a video which presents a little of what we are going to see next week." This will include students who have greater learning difficulties" (Tea9_ID2_History).
Explicit instructions	"It takes explicit teaching to explain how to use an app" (Tea15_ID10_French, Math).
Individualized support	"If there are activities that are carried out with digital technology, I will frequently place students together to offer them more personalized support to help them mobilize certain digital functionalities" (Tea7_ID0_Science).
Challenges related to the capacity to guarantee cognitive engagement	"A teacher who starts in an environment like mine, who is starting his career or who arrives with little experience, can feel overwhelmed quite easily by the diversity of needs" (Tea13_ID9_French).

Cognitive engagement, as identified in the findings, is also strongly influenced by the thoughtful use of digital tools. Teachers emphasized the necessity of providing explicit instructions and individualized support to ensure all students can effectively engage with the technology, correlating with what was previously reported by Huang et al. (2022) as well as Parong and Mayer (2021). This approach not only facilitates deeper understanding but also accommodates diverse learning needs, enabling all students to participate meaningfully in their learning experiences. Nevertheless, challenges persist, especially for novice teachers who may feel overwhelmed by the diversity of student needs and the complexities of integrating technology effectively (Brunetti et al., 2020).

To maximize the impact of digital technology on students' engagement, it is essential to equip teachers with the resources, training, and skills necessary to create engaging and inclusive learning environments. This includes not only technical training, but also pedagogical support focused on developing stimulating content that resonates with learners (Ullah & Anwar, 2020). Ultimately, while the benefits of digital technology in promoting engagement are clear, it is the synergy between effective teaching strategies and technological integration that will drive sustained student interest and achievement in today's learning landscape.

Limitations and Future Research Avenues

This study presents some limitations that could be addressed in future research. A limitation concerns the convenience sample of participants, who were probably more inclined towards digital technology in high school classes than other colleagues. Future studies could therefore find ways to recruit teacher participants who are reluctant to use technology and would be willing to discuss their experiences. Furthermore, though the research project had an inclusive

perspective of supporting the engagement and learning of all students, we observed that teacher participants faced challenges in addressing all student needs in high school classes. We interpreted this as a consequence of the diversity and large number of students, as well as the teachers' lack of time to explore and plan new activities. Additionally, while teachers may observe students working well with peers or appearing enthusiastic, these observations only offer indirect measures of actual engagement and learning. Future action research with teachers could focus on codesigning new ways to support the engagement and learning of all students using technology, ensuring that both direct and indirect measures of student engagement are considered.

Conclusions

This study aimed to examine how the use of digital technology in high school classes engage and support the needs of all students, according to teachers in various disciplines and schools. Particularly, specific research questions addressed the types of digital access in classes; the promotion of students' autonomy, competence, and relatedness through digital technology; and the promotion of students' engagement (behavioral, socio-affective, cognitive) through digital technology. Semi-structured interviews were performed with high school teachers ($N = 17$) in Québec, then analyzed using a general inductive approach.

Overall, the experiences of the participating high school teachers present relevant and useful insights both for practitioners and researchers, helping to understand how to enhance student engagement and learning with digital technology in high school settings. Despite the easy physical access to technology, the study confirms teachers' perceptions of the persistent presence of digital inequalities of motivation, use, and skill. These inequalities affect both student engagement and teacher empowerment. Students express positive emotions and increased engagement when digital tools are integrated into learning, as they find these methods both enjoyable and efficient. However, some teachers are reluctant to adopt digital tools, creating disparities in access. Teachers also highlighted challenges with classroom management and the need for better training to maximize the potential of digital tools.

In terms of promoting autonomy, competence, and relatedness, the use of technology fosters greater student autonomy by allowing personalized learning choices. It also helps build competence, as students can learn at their own pace and receive personalized feedback. Furthermore, technology supports relatedness by enabling collaboration through interactive tools, though teachers noted difficulties in catering to every student's needs.

Regarding behavioral, socio-affective, and cognitive engagement, digital tools were found to boost participation, concentration, and task efficiency. Socio-affective engagement is enhanced through collaborative tasks and game-based learning, while cognitive engagement benefits from multimedia content and personalized support. However, challenges such as a lack of resources and variability in students' needs remain, particularly for novice teachers.

To the authors' knowledge, this is the first study to explore the perspectives of high school teachers who qualitatively addressed their use of digital technology in the classroom based on three theoretical principles (digital divide, student engagement, and self-determination theory). This study is highly relevant in today's context as the policies to promote digital transformation in education have often consisted of the provision of a reliable Internet connection, technological equipment, and software, at the expense of the development of teacher and student skills for a

meaningful digital use in teaching and learning that can engage learners and meet their needs and preferences.

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Ethics Statement

Informed consent was obtained from all subjects involved in the study. Ethical approval was granted by Université de Laval (2022-086 A-1/28-09-2022).

Conflict of Interest

The authors do not declare any conflict of interest.

Data Availability Statement

The participants of this study did not give written consent for their data to be shared publicly. The data that support the findings of this study are available on request from the corresponding author.

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Appendix A

Interview Guide (translated from French into English)

Question 1: Student Diversity

What can you tell me about the diversity in your groups, whether it comes from individual, social characteristics or from learning difficulties?

Question 2: Uses of Digital Technology

Could you explain to me how you use digital technology to support student learning and engagement in your class, with examples.

Question 3: Teacher (and/or Peer) Support

I would also like you to explain to me how you support and assist students in these activities.

Question 4: Inclusive Perspectives

4a) I would first like you to tell me about how you take into account learners' diversity when you use digital technology in your classes, and how this contributes to supporting their learning and engagement.

4b) What are your (most important) challenges in taking into account learners' diversity in your groups in terms of digital uses?

Question 5: Responding to Students' Needs

What can you say about the needs of the students in your groups. What are examples of these needs in terms of digital uses, and how do you address them?

Question 6: Preferences

Could you tell me more about whether you take into account their learning preferences in terms of digital uses? If yes, how?