

ORIGINAL RESEARCH ARTICLE

Student engagement and disengagement in TEL – The role of gaming, gender and non-native students

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Student engagement is critical for learning. However, little is known about engagement and disengagement and particular social groups. Recent research has alerted that engagement in technology-enhanced learning (TEL) settings may manifest differently than engagement in analogue learning settings. This study explores how different social groups of upper secondary school students ($n = 410$) engage and disengage when learning with digital technologies. We used an instrument to approach dimensions of engagement and disengagement in TEL. Using thematic analysis, we identified cognitive, emotional, behavioural and social aspects of engagement and disengagement in eight-student interviews which together with theory, informed a questionnaire. Using statistical methods, we explored the relationship between engagement, disengagement and the social categories: gamers, gender and non-native speakers. We found significant differences between the groups. For example: that high-frequency gaming students were not as easily distracted as students reporting low-frequency gaming, that female students engaged in TEL in different ways than male students, and that non-native speakers displayed significantly fewer tendencies to engage in unauthorised uses of digital technologies than native speakers. Identifying indicators reflecting engagement and disengagement in TEL in social groups can inform successful practices that stimulate student engagement and can be used to avoid, or redeem, group-specific challenges that trigger disengagement.

Keywords: student engagement; student disengagement; technology-enhanced learning; gender; gaming; non-native speakers

Introduction

Engagement is often seen as a key concept in education with its strong relations to school retention, grades, academic outcome and student well-being (e.g. Alrashidi, Phan, and Ngu 2016; Fredricks, Blumenfeld, and Paris 2004). While educational psychologists have explored engagement for some 30 years in traditional classrooms, researchers in other fields have recently forwarded that student engagement in technology-enhanced learning (TEL) settings may be different from engagement in analogue learning environments (Bergdahl *et al.* 2019a; Halverson 2016; Ma, Cheng, and Han 2018). They propose that engagement in TEL is rather unexplored (Henrie,

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Halverson, and Graham 2015; Ma, Cheng, and Han 2018) and ‘ill-conceived’ (Halverson 2016). Engagement is manifested in the interaction between the individual and the subject, in which engagement is shaped by context (Wang and Hofkens 2019). Thus, new conditions for engagement may arise when digital technologies reshape the student–content, student–machine (hardware and software), student–teacher and student–student interactions. While some research gather system log data and conduct data-driven analytics to measure engagement (e.g. counting clicks, words or time spent in learning management systems) (Henrie, Halverson, and Graham 2015), this type of system log data has been criticised as it, at best, can reflect a one-dimensional aspect of in-the-moment online behaviour and thus will not capture the emotional, behavioural, cognitive and social aspects of engagement (and disengagement) (Henrie *et al.* 2018).

Several studies approaching digital technologies in education suggest that the vast majority of students are comfortable with digital technologies; that the students of today find the digital environment and Internet nested in their everyday lives. Unsurprisingly, students generally believe that laptops support them in their school work (Howard, Ma, and Yang 2016; Rashid and Asghar 2016). However, other researchers have pointed out that some digital technologies may impacts the students profoundly. For example; while students admit that their mobile phones cause distraction, they still invest heavily in their devices, rely on them to manage their education and even allow the mobile phone to merge with their identity (Gikas and Grant 2013). Students do not view devices or the Internet as something they would turn on or off; instead, they expect to be able to use these technologies for all purposes, including learning. For example, students reported that technologies were time-saving, that they used them for deep learning, to support basic tasks, augment teacher materials, managing education and allow for flexibility of location (Henderson, Selwyn, and Aston 2017). Furthermore, students often get frustrated with teachers’ low skills, tolerance or inclusion of technologies (Gikas and Grant 2013). While researchers have started to approach both engagement *and* disengagement (Balwant 2018; Bergdahl *et al.* 2019b; Fredricks, Blumenfeld, and Paris 2014), there has been a call for more nuanced studies that approach differences of engagement between groups of students (Fredricks *et al.* 2018; Hietajärvi *et al.* 2019). As it is well known that disengagement may escalate into school dropout (Finn 1989; Wang and Fredricks 2014), schools could identify early signs of disengagement and use preventive measures to curb future absenteeism. While it has been suggested that absenteeism is the strongest predictor for disengagement (Pellerin 2005), school attendance is not enough for students to engage (Finn 1989). Yet, little research has explored how social groups, are related to engagement in learning, which leaves a gap for a more nuanced understanding of how different social groups of students engage and disengage in TEL.

Learning more of underperformance and productive engagement in TEL for specific groups of students, approaching social groups is critical. Research has highlighted that students who belong to specific social groups (such as gender, ethnicity or even gamers) may experience being part of a disadvantaged group, which, in turn, may impact their performance (Chatman *et al.* 2008; Wiggins *et al.* 2017). Focusing on social groups, such as gender and non-native speakers, when exploring engagement, rather than adopting an ‘across population’ approach, is thus needed to understand particular sub-groups (Scherer, Rohatgi, and Hatlevik 2017). We included gaming students, as time spent gaming has been seen to be a problem related to decreasing grades

(Bergdahl *et al.* 2019a; Hietajärvi *et al.* 2015). We included the perspectives of gender and of non-native speakers too, as research has suggested that certain social groups (i.e. females and non-native speakers) may have lower digital skills or less access to digital technologies compared to male students, and therefore may face unequal possibilities in TEL (Siddiq and Scherer 2019; Skryabin *et al.* 2015). Understanding female and male students and native and non-native speakers, learning design can build in personalisation and prevention before disengagement escalates into a problem. All in all, little is known about engagement and disengagement in TEL in general, less the role of gaming, gender and non-native speakers, in particular. There are several studies that explore gaming, gender, non-native speakers in relation to school results. While highly relevant, these studies have not explored the behavioural, cognitive, emotional and social aspects of engagement and disengagement in TEL and how these are related to the specific social groups. To contribute to knowledge in this area, we raised the following three hypotheses:

H1: We hypothesise that students' academic engagement and disengagement, when learning with technologies, differ between students who report high- and low-frequency gaming.

H2: We hypothesise that students' academic engagement and disengagement, when learning with technologies, differ between female and male students.

H3: We hypothesise that students' academic engagement and disengagement, when learning with technologies, differ between native and non-native speakers.

Theoretical background

Student engagement and disengagement are related but separate constructs (Skinner, Kindermann, and Furrer 2009; Wang *et al.* 2017). Thus, research which only focus on engagement would potentially overlook facets of disengagement.

Student engagement can be described as the visible and measurable outcome of motivation (Boekaerts 2016; Fredricks and McColskey 2012), and has been related to overall school success for all students (Alrashidi, Phan, and Ngu 2016; Fredricks, Blumenfeld, and Paris 2004) and defined as students' initiation of effort and their persistence in learning activities (Alrashidi *et al.* 2016). Research exploring cognitive, behavioural, emotional and social aspects of engagement in TEL, in particular, has shown that high-performing students own the proactive ways of using digital technologies to succeed in education (Bergdahl *et al.* 2019a), while low-performers significantly more often were seen to switch between different digital technologies for other purposes than learning (*ibid.*). Eventually, student disengagement may lead to withdrawal from peers and school, decreasing grades, absenteeism and school dropout (Balwant 2018; Wang *et al.* 2017), cementing states that are unproductive for learning (Chipchase *et al.* 2017; Mann 2001).

Fredricks *et al.* (2004) brought together common operationalisations and definitions of engagement and summarised that engagement consists of interrelated dimensions consisting of, at least, a behavioural, an emotional and a cognitive aspect. The behavioural aspect refers to effort, persistence, attention, participation, positive conduct and lack of disruptive behaviour. The emotional aspect included the students' reaction towards teacher instruction or peers. The cognitive aspect refers to students'

self-regulated learning and the focus and effort directed to comprehend complex ideas and master demanding skills. Today, several researchers include a social dimension when conceptualising engagement (Skinner, Kindermann, and Furrer 2009; Wang *et al.* 2017) and suggest that the social dimension reflects collaboration and interaction with peers. The questionnaire in this study was informed by students' experiences of their own engagement and disengagement when learning with digital technologies, and inspired by the four-dimensional conceptualisation of engagement and disengagement that include emotional, cognitive, behavioural and social dimensions, proposed by Wang *et al.* (2017). However, as this study reflects engagement and disengagement in TEL, in particular, we used Graham's definition of TEL, (Graham 2006). Graham proposed that blended learning is a combination of face-to-face learning and learning with digital technologies, which can be viewed in a continuum reflecting how digital technologies are used and their inherent modalities. Depending on the extent to which the digital technologies change the conditions for learning, the lower end is exemplified with technologies that *enable* learning and the higher end is exemplified as learning technologies that *transform* learning, leaving technologies that enhance learning in the middle. The low- to high-end continua reflects how the use of digital technologies range from not impacting pedagogical approaches, to overthrowing the traditional teaching practices in terms of for example pace, place and time (*ibid.*).

Exploring the cognitive and emotional aspects of engagement in blended learning, Halverson's concluded that student engagement in "traditional" (or analogue) learning settings and student engagement in TEL must be treated as separate constructs, as digital technologies significantly affects engagement (Halverson 2016). Recent research has suggested that students who display high levels of engagement, in traditional (analogue) learning settings, are more likely to display high levels of engagement in TEL (Bergdahl *et al.* 2019a). However, with the uptake of digital technologies, TEL disengagement has been seen to increase. For example, students have been seen to increasingly work in isolation and to use the digital technologies to disengage from learning (Tallvid *et al.* 2015). Tallvid observed that the unauthorised use of digital technologies increased in parallel to the overall use of digital technologies (*ibid.*). Other research has highlighted that teachers' social presence in blended learning is related to student engagement and grades, and while equally important in online as in traditional (analogue) learning settings, it may be harder to realise in online (Bergdahl *et al.* 2019a, b). While many approaches to engagement research have aimed to cover students' overall engagement and disengagement, students are not a homogeneous group. In this study, we investigated engagement and disengagement in TEL in relation to specific social groups of students, namely high-frequency gamers, gender and non-native speakers.

Gaming, gender and non-native students

Research on gamers' engagement in learning has been inconsistent. Unsurprisingly, research has shown that gaming in class is related to lower grades (Bergdahl *et al.* 2019b). While Bergdahl (*ibid.*) could not find any negative correlations between playing games outside class and student grades, research findings are inconsistent. For example, Strittmatter and colleagues concluded that too much gaming can have negative effects when the gamer tries to engage with people face-to-face as they are increasingly deprived of face-to-face contact (Strittmatter *et al.* 2015). As such,

high-frequency gamers may feel less competent in social relationships, which, in turn, can have negative effects on their social engagement when learning at school. However, other studies suggest that gaming can help develop pro-learning skills, like being familiar with multiple platforms, or developing their ability to focus in technology-mediated activities (Yurov *et al.* 2014) and forward that even violent games have little influence on anti-social behaviour, decreased academic performance or attention deficits (Ferguson 2015). Approaching gaming preferences specifically Hietajärvi and others highlighted that gamers who preferred action and sports games, displayed lower levels of engagement, while using digital technologies to gain and share knowledge was associated with higher levels of engagement (Hietajärvi *et al.* 2019). It is, however, worth noting that a longitudinal study concluded that student engagement tended to decline more for gamers than other students (Wylies and Hodgen 2012). Studies have also suggested that while different engagement dispositions were related to different preferences (action games, sports games, etc.), male students were significantly more likely to engage in all kinds of games, whether they displayed indifference for learning or goal orientation (Hietajärvi *et al.* 2019). The differences in engagement disposition with female and male students indicate that a gender perspective is essential to explore in relation to engagement and disengagement in TEL.

Previous research approaching the gender perspective has suggested that female students are more likely than male students to express that their teacher relationship is critical for their engagement. Female students are less likely to participate when feeling afraid or worried (Fredricks *et al.* 2018). In contrast, male students were seen to display persistence and deep learning strategies, reflecting higher levels of self-confidence (Fredricks *et al.* 2018). Skinner, Kindermann, and Furrer (2009) identified that female students displayed higher levels of behavioural and emotional engagement (than male students), as well as lower levels of behavioural and emotional disengagement. Applying a gender perspective in TEL, research has indicated that females and males take on different tasks when using and learning with technologies (Ilomäki 2011; Volman *et al.* 2005) which implies that female and male students may differ when engaging in and disengaging from TEL. However, studies show disparate results. For instance, while Ilomäki (2011) has highlighted that male students are using digital technologies in proactive ways and outperform female students, other researchers have suggested that male students more frequently used IT for recreational purposes (Gebhardt *et al.* 2014). Hietajärvi *et al.* (2019) concluded that disengagement with digital technologies differ between the genders: female students would use social media more frequently and male students would prefer gaming.

The access to, and use of, digital technologies also influence the possibilities to develop the skills needed. It is suggested that the past decade's male dominance in digital skills might be in the process of levelling out and that owning high digital skills is becoming increasingly equal between men and women (Gebhardt *et al.* 2014; Siddiq and Scherer 2019). However, the digital divide is not only about exploring differences in access and IT skills between the genders. While these two aspects (access and skills) have been forwarded as a first and second wave of the 'digital divide', a third wave explores a situation in which the individual has access to digital technologies as well as skills, but may not obtain the same returns on their use digital technologies (van Deursen and Helsper 2015). Such situation may be the reality for non-native speakers.

In a recent Spanish study, the authors suggested that teachers use fewer digital technologies in class when they teach immigrant students and if they perceive

that it leads to disruptive behaviour (Gómez-Fernández and Mediavilla 2019). This may have its explanation in understandings that non-native speakers may find it hard to interpret social signals and/or perceive their cultural practices to be devalued in the school context which might lead to a lack of engagement in school (Bingham and Okagaki 2012), or, that immigrant students may have had limited access to digital technologies (Skryabin *et al.* 2015), and thus limited opportunities to develop digital skills to be able to engage effectively in TEL. Opposing findings were presented by Scherer, Rohatgi, and Hatlevik (2017) who when approaching sub-groups of students (gender and non-native students) and found that female and non-native students were significantly more likely to display proactive learning behaviours in TEL. They also found that both female and non-native students used digital technologies, across varied contexts, for a variety of reasons, almost to the same extent as male and native students, (Scherer, Rohatgi, and Hatlevik 2017). We found little research exploring TEL conditions and social groups (i.e. gaming/non-gaming students, male/female students and native/non-native students). Yet, the social groups are subjected to the same classrooms, teacher and tools, and thus, not separated in reality. Exploring how these groups engage and disengage, and the specific components of engagement and disengagement when learning with digital technologies is thus essential, as different social groups are likely to respond differently to similar situations.

Method

Research design

We used a mixed-methods exploratory sequential design which allows an initial qualitative phase of data collection and analysis, and a second phase of quantitative data collection (Berman 2017). The exploratory sequential design was used to develop a multidimensional measurement to assess student engagement and disengagement in TEL, and thereby gain a nuanced understanding of students' needs and preferences when learning with technologies. In the initial phase, we conducted eight interviews to inductively operationalise students' reports of engagement and disengagement in TEL. These interviews were analysed using thematic analysis (Clarke and Braun 2016) which, together with engagement theory, informed the instrument (following Bryman 2016). In the second phase, we distributed, analysed and validated the questionnaire using statistical tests (Field 2018).

Context and participants

To approach engagement in TEL in upper secondary schools, we first selected all schools in Stockholm that had participated in a digitalisation project with the development of a school platform (ensuring one laptop per student). We then limited the selection to cover the largest of the national programmes that qualify students for higher education: economics, social and natural sciences and the humanities programme. Demographic variables such as gender and non-native speaker were assessed by student self-reports. Of the 410 students answering the questionnaire, 33% considered themselves high-frequency gamers, and 67% low-frequency gamers; 37% were male, 63% were female, 87% of the students reported they were native speakers, and 13% that they were non-native speakers (see Table 2).

The instrument

We approached two teachers in two separate upper secondary schools, with which our department had established connections, and asked for their interest to participate in a study. Eight students in their second or third year (four from each school; six boys, two girls) agreed to be interviewed. We asked the participants for their experiences of (dis)engagement in TEL settings (e.g. ‘Can you describe your engagement when learning with digital technologies?’ and ‘What was a learning situation with digital technologies that you felt maximised your engagement?’). A thematic analysis was conducted to analyse the interviews (Clarke and Braun 2016). Coding was performed in Nvivo version 11.4.43 to identify instances in which students reported feeling engaged or disengaged when learning with technologies, considering behavioural, cognitive, emotional and social dimensions (Wang *et al.* 2017). To capture student-reported engagement in TEL 49 questions (with an even distribution across behavioural, emotional, cognitive and social dimensions of engagement or disengagement) formed the basis of the developed questionnaire. We adopted a six-item Likert scale, ranging from ‘Not at all like me’ to ‘Very much like me’ (if nothing else is stated). We then pre-tested the questionnaire on two separate occasions. To ensure the questionnaire would be understood and relevant to the age group, the pre-test was first conducted with five lower secondary school students, and the second time with five students who had just graduated from upper secondary school. The pre-test resulted in further clarification and merging of some questions.

Ethical considerations

Our ethical considerations adhered to good research practice (Hermerén 2011). The respondents received both verbal and written information about the study, prior to asking for their consent. The students were informed of their right to withdraw without questions asked. All data were treated using pseudonyms at all times.

Data collection

Two types of data were collected. In phase 1, eight students were interviewed, and in phase 2, we collected questionnaire results. We distributed the questionnaire to students in 11 upper secondary schools. Out of 472 responses, 62 responses were excluded, due to not being filling the requirements for the selection. Data screening was done to check for standard normal distribution (SND) of the participants across the studied variables using SPSS version 25. Missing data were below 1%. Following Field (2018), variables were examined for skewness and kurtosis, and outliers were identified using mean substitution, reflecting report within SND. We used descriptive statistics to explore the data, and independent sample t-test to test our hypotheses.

Validation

In addition to pre-test the instrument for ecological validity (using interviews and theory as described above), the researchers critically examined items that required clarification, were overlapping or were not sufficiently represented to reach face validity. Table 1 presents the instrument with two separate four-dimensional constructs (engagement and disengagement) with cognitive (Cog/Dcog), emotional (Emo/Demo), behavioural

Table 1. Indicators of engagement and disengagement.

| Engagement | | Disengagement | |
|------------|---|---------------|---|
| Beh 1 | Uses digital technologies as a support for learning | Dbeh 1 | Turns in assignments late due to unauthorised use of technologies |
| Beh 2 | Uses the Internet to research what others have written and find facts | Dbeh 2 | Delegates group work using technologies to a peer, as no more than one is required to complete the task |
| Beh 3 | Uses a synchronous media to rehearse and master content | Dbeh 3 | Is prevented from working due to undeveloped technologies and system breakdowns |
| Beh 4 | Uses technologies to work on school assignments | Dcog 1 | Chooses to use digital technologies in unauthorised ways |
| Cog 1 | Concentrates well when using digital technologies | Dcog 2 | Notifications (i.e. from a mobile phone) easily cause a distraction |
| Cog 2 | Takes own initiative and decides on what digital technologies to use | Dcog 3 | Is overwhelmed by information overflow |
| Cog 3 | Needs digital technologies to maximise learning | Demo 1 | Is emotionally drawn to an application or digital technology |
| Cog 4 | Uses IT as a cognitive enhancement | Demo 2 | Uses digital technologies to escape feelings of boredom |
| Emo 1 | Wants to use more digital technologies for learning than what is used today | Demo 3 | Feels frustration over poor communication over the learning platform |
| Emo 2 | Perceives using digital technologies for learning as engaging | Demo 4 | Believes that teachers lack the IT skills needed to support individual learning effectively |
| Emo 3 | Relies on technologies to manage education | Demo 5 | Resists using the laptop for all reading |
| Emo 4 | Finds creating with technologies satisfying | Demo 6 | Resists using the laptop for all writing |
| Emo 5 | Desires spatiotemporal solutions and personalisation that technologies may offer | Dsoc 1 | Is left to manage digital technologies for learning themselves |
| Soc 1 | Is satisfied with using digital technologies that mediate teachers' insight into student's learning process | Dsoc 2 | Coming to school is perceived as meaningless when there are no interpersonal activities |
| Soc 2 | Is satisfied that teachers use digital technologies to provide feedback | Dsoc 3 | Is unhappy with repeatedly being directed to learn by looking things up online |
| Soc 3 | Feels that digital technologies are used in ways that enable participation, inclusion and belonging | Dsoc 4 | Feels upset/dispirited that group work does not involve all students |
| Soc 4 | Experiences teachers' social presence with, as well as, inside applications | Dsoc 5 | Experiences decreasing engagement due to feeling isolated while using technology |

(Beh/Dbeh) and social (Soc/Dsoc) indicators of engagement and disengagement when students learn with digital technologies. Each question was mapped to the relevant indicator. The instrument was then further tested and validated using principal component analysis and confirmatory factor analysis (Bergdahl *et al.* 2019a).

Results

To explore how different groups of students engage and disengage when learning with technologies, we divided the students into groups reflecting gaming frequency, gender and native/non-native speakers, based on the questionnaire answers (see Table 2). The calculated mean was used to divide students into high- and low-frequency gaming students. We then continued with testing hypotheses (H1–H3) using independent sample *t* tests.

Hypothesis 1 (H1) gaming, engagement and disengagement

An independent sample t-test was performed to test the hypothesis: that students’ academic engagement and disengagement, when learning with technologies, differ between high- and low-frequency gaming students.

Table 3 shows the significant differences between high- and low-frequency gaming student’s engagement and disengagement. While the most variables reflecting engagement and disengagement were similar for high- and low-frequency gaming students, certain variables reflecting cognitive engagement and disengagement when learning with technologies showed significant differences ($p < 0.01$). Interestingly, we found that high-frequency gaming students did not use the Internet to conduct research (explore what others have written on a topic), nor did they perceive that IT was a cognitive enhancement as much as students reporting low-frequency gaming. On the other hand, low-frequency gaming students reported that they were more easily distracted by notifications (i.e. from mobile phones), as well as overwhelmed by information, to a higher extent than high-frequency gaming students. Reflecting emotional

Table 2. Background variables.

| Student background data | <i>n</i> | % |
|---|----------|----|
| Gender | | |
| Men | 152 | 37 |
| Women | 258 | 63 |
| Non-native speakers | | |
| Native speakers | 356 | 87 |
| Non-native speaker | 54 | 13 |
| High- and low-frequency gaming student | | |
| High-frequency gamer | 136 | 33 |
| Low-frequency gamer | 274 | 67 |

Table 3. Differences between high- and low-frequency gaming student’s engagement and disengagement in TEL.

| Variables | Low-frequency gaming | | | High-frequency gaming | | | | |
|-----------|----------------------|----------|-----------|-----------------------|----------|-----------|----------|----------|
| | <i>n</i> | <i>M</i> | <i>SD</i> | <i>N</i> | <i>M</i> | <i>SD</i> | <i>t</i> | <i>p</i> |
| Beh2 | 274 | 5.09 | 0.90 | 136 | 4.70 | 1.22 | 3.72 | <0.01 |
| Cog4 | | 4.40 | 1.29 | | 3.91 | 1.54 | 1.17 | <0.01 |
| Dcog2 | | 3.21 | 1.45 | | 2.82 | 1.40 | 2.57 | 0.01 |
| Dcog3 | | 3.07 | 1.36 | | 2.71 | 1.34 | 2.50 | 0.01 |
| Demo6 | | 3.01 | 1.60 | | 2.68 | 1.59 | 1.99 | 0.04 |

disengagement, low-frequency gaming students (more than high-frequency gaming students) resisted using a keyboard for all in-class writing. Having tested our hypothesis: that engagement and disengagement when learning with technologies differ between high- and low-frequency gaming students, we conclude that the hypothesis is partly supported. More specifically, while results revealed similarities between the behavioural, emotional and social dimensions, there were significant differences between high- and low-frequency gaming students in TEL, within the cognitive dimension of both engagement and disengagement.

Hypothesis 2 (H2) gender, engagement and disengagement

We hypothesised that students’ academic engagement and disengagement, when learning with technologies, differ between female and male students. To test the hypothesis, we performed an independent sample *t*-test with gender as a grouping variable. Table 3 reveals that the statistically significant differences between female and male engagement and disengagement in TEL span the behavioural, cognitive, emotional and social dimensions. In variables measuring behavioural engagement, there were differences significant at the level of $p < 0.01$ between male and female students, revealing that female students to a significantly higher extent than male students use digital technologies to support learning, by using digital technologies to work on school assignments, by using the Internet to conduct research (explore what others have written on a topic) and to find facts, and by using asynchronous media to rehearse and master content.

Female students displayed a significantly higher degree of cognitive engagement ($p < 0.01-0.04$) for half of the variables (see Table 4): reporting that they use IT as cognitive enhancement and need the digital technologies to maximise their learning. Addressing emotional and social engagement, female and male students displayed many similarities. In sum, the differences identified, significant at the level of ($p < 0.01$), showed that female students rely on technologies to manage education.

Table 4. Differences between male/female students’ engagement and disengagement in TEL.

| Variables | Male | | | Female | | | t | p |
|-----------|------|------|------|--------|------|------|-------|-------|
| | n | M | SD | n | M | SD | | |
| Beh1 | 152 | 4.86 | 1.02 | 258 | 5.23 | 0.81 | -4.07 | <0.01 |
| Beh2 | | 4.67 | 1.13 | | 5.13 | 0.92 | -4.42 | <0.01 |
| Beh3 | | 4.06 | 1.41 | | 4.57 | 1.20 | -3.93 | <0.01 |
| Beh4 | | 4.45 | 1.30 | | 4.98 | 1.01 | -4.61 | <0.01 |
| Cog3 | | 4.00 | 1.55 | | 4.31 | 1.33 | -2.07 | 0.04 |
| Cog4 | | 3.93 | 1.38 | | 4.42 | 1.38 | -3.40 | 0.01 |
| Emo3 | | 4.69 | 1.26 | | 5.23 | 0.90 | -4.98 | <0.01 |
| Soc4 | | 3.50 | 1.35 | | 3.03 | 1.03 | -3.48 | 0.01 |
| Dcog2 | | 2.76 | 1.44 | | 3.27 | 1.43 | -3.44 | 0.01 |
| Demo1 | | 3.04 | 1.40 | | 3.48 | 1.50 | -2.91 | 0.04 |
| Demo6 | | 2.69 | 1.61 | | 3.01 | 1.59 | -1.98 | <0.05 |
| Dsoc1 | | 3.83 | 1.36 | | 4.10 | 1.25 | -2.03 | 0.04 |
| Dsoc4 | | 3.99 | 1.35 | | 4.59 | 1.31 | -4.48 | <0.01 |
| Dsoc5 | | 2.89 | 1.46 | | 2.50 | 1.30 | 2.78 | <0.05 |

This may indicate that female students find it more important to plan, schedule educational tasks, event and deadlines, coordinate, stay informed and take overall responsibility for their education. Conversely, there was a significant difference between female and male students regarding the teacher's social presence. Male students would, to a higher degree than female students (significant at the level of $p < 0.01$), experience that teachers were socially present inside online applications or through the use of technologies.

Noteworthy, while there were no significant differences between the female and male students' behavioural disengagement there were a few (significant at the level of $p < 0.01$) differences between female and male students cognitive and emotional disengagement. For example, female students reported being easily distracted by notifications (i.e. from a mobile phone), experienced that they were emotionally drawn to their digital technologies, and resisted using a keyboard for all in-class writing. Interestingly, the social dimension of disengagement revealed the most differences, with three out of five variables displaying significant differences ($p < 0.01-0.05$) between female and male students. Male students reported, to a greater extent than female students, that their engagement decreased when they were left to work alone. Female students, on the other hand, reported being disengaged when they were left to manage the digital technologies for learning by themselves and also felt upset and dispirited when group work did not succeed in including all students in the group.

Conclusively, in, not all, but many of the pro-learning engagement variables, female students, displayed significantly higher levels than male students. Towards this background we conclude, that female students do not seem to be impaired by the increasing digitalisation in education, and that while cognitive, social and emotional disengagement differed between female and male students, efforts directed to avoid or redeem student behavioural disengagement when learning with technologies must be directed to all students regardless of gender. We also conclude that the hypothesis was verified: that engagement and disengagement differ between female and male students when learning with technologies.

Hypothesis 3 (H3) non-native speakers, engagement and disengagement

We hypothesise that students' academic engagement and disengagement, when learning with technologies, differ between native and non-native speakers, and performed an additional independent sample *t*-test to test the hypothesis.

Table 5 reflects statistically significant differences between native and non-native speakers in terms of their engagement and disengagement when learning with technologies. Interestingly, we found no significant differences with regard to native and non-native speakers' engagement in TEL. Instead, we have identified results revealing that non-native speakers to a lesser extent than native speakers reported feeling emotionally attracted to their digital technologies and using digital technologies to escape feelings of boredom in class ($p < 0.01-0.07$). We have seen that some students engage in unauthorised use of digital technologies to a certain extent. Some of these students continued this behaviour even when it impacted their learning negatively (becoming late with school assignments). Approaching native and non-native speakers, we found that non-native speakers were significantly under-represented in these aspects of disengagement ($p < 0.01-0.03$). We conclude that the hypothesis is partly supported as there were no significant differences in terms of native and non-native speakers' engagement

Table 5. Differences between native and non-native speakers' engagement and disengagement in TEL.

| Variables | Non-native speaker | | | Native speaker | | | | |
|-----------|--------------------|----------|-----------|----------------|----------|-----------|----------|----------|
| | <i>n</i> | <i>M</i> | <i>SD</i> | <i>n</i> | <i>M</i> | <i>SD</i> | <i>t</i> | <i>p</i> |
| Dbeh1 | 54 | 2.26 | 1.35 | 356 | 2.85 | 1.39 | -2.94 | 0.03 |
| Dcog1 | | 2.31 | 1.33 | | 2.96 | 1.26 | -3.35 | 0.01 |
| Demo1 | | 2.81 | 1.43 | | 3.39 | 1.47 | -2.70 | 0.07 |
| Demo2 | | 2.69 | 1.72 | | 3.64 | 1.55 | -4.14 | <0.01 |

in TEL, but non-native speakers reported significantly fewer (behavioural, emotional and cognitive) disengagement inclinations than native speakers.

Discussion

As digital technologies change the conditions for engagement (and disengagement), we approached three social groups of students and explored their engagement and disengagement in TEL. We identified variables that reflect emotional, cognitive, behavioural and social engagement and disengagement in TEL specific for high- and low-frequency gaming students, female and male students and native and non-native speakers.

Approaching high- and low-frequency gaming students, we identified certain differences reflecting engagement and disengagement in TEL. In line with the findings of (Yurov *et al.* 2014) which suggest that high-frequency gaming students develop some abilities that may be useful for learning, our findings reveal that gamers did not disengage due to information overflow or notifications to the same extent as low-frequency gaming students, and did not resist using digital technologies for educational purposes. On the other hand, high-frequency gaming students did not display essential pro-learning behaviours. More studies are needed to discern longitudinal effects between gaming, engagement and disengagement in TEL.

However, our results reveal that within the groups, the largest differences were found between female and male students. In line with Skinner, Kindermann and Furrer (2009), we found that female students display higher levels of behavioural and emotional engagement than male students, but also higher levels of cognitive and social engagement. We found that male students' engagement in TEL decreased when working alone; that they did not rely on technologies to manage their education. Together, these findings (not utilising the digital resources, isolating and decreased engagement) might indicate a *laissez faire* attitude towards learning, and thus, directed instruction could be helpful for students displaying similar responses when displayed conjunction with decreasing performance. The results also revealed that female students display a significantly higher degree of behavioural, cognitive, emotional and social engagement in TEL than male students (but there were no differences in male and female students behavioural and cognitive disengagement). Exploring the cognitive, emotional and social disengagement dimensions, there were differences between female and male students – but not enough to conclude that female or male students disengage more than the other, rather, examining specific components of engagement and disengagement, revealed male and female students disengage differently: For example, our findings reveal that male students experienced that the teachers' were socially present when female students did not,

which expands findings of Bergdahl *et al.* (2018) and Bergdahl *et al.* (2019) who alerted that teachers social presence was as important online as in an analogues setting and also would predict student performance (Bergdahl *et al.* 2019a). It also expands Fredricks *et al.*'s (2018) recognition that female students are more likely than male students to find teacher–student relationships critical for their engagement. This finding suggests that the female students need to interact more with the teachers to feel satisfied, which can be due to having a higher need and preference for relational support, or not receiving their teachers' attention to the same extent as male students.

Interestingly, we did not identify any difference between non-native and native students' engagement in TEL. Instead, we noted that native speakers displayed more disengaging tendencies than non-native speakers, in terms of being emotionally attracted to technologies, using them to escape feelings of boredom in class, even when there were negative consequences on learning.

Implications for learning designs and research approaches

Surveying students' engagement and disengagement from different angles allow for nuanced findings relevant to specific social groups. These findings can be used to shape more effective designs of learning in order to meet the needs and preferences of different students and help identify early signals of student disengagement. For example, we found that non-native speakers and female students, who might be suspected to disengage due to lack of digital skills or interest, did not display less engagement. Surprisingly, our results indicate that high-frequency gaming students might develop specific pro-learning behaviours, which suggest that gaming in the out-of-school context may contribute to *some* pro-learning reactions and preferences. At the same time, however, our results show that high-frequency gaming students were less prone to elicit certain pro-learning behaviours, for example, to search the Internet for facts.

Thus, we argue that it is important that both engagement and disengagement are studied together if we are to understand students' engagement and disengagement when learning with digital technologies.

Limitations

With asking students if they regard themselves as native or non-native speakers, we aimed to capture potential language barriers and inherent cultural orientation that students may have. The study is limited as we cannot say anything about students' individual cultural identification, socio-economic status or parents' educational levels. Since socio-economic status can majorly impact technological access, it is possible that the study did not accurately parallel the first wave of the digital divide. Yet, we believe that the findings reflect (dis)engagement in TEL that future research might want to explore further.

Conclusion

We investigated different social groups' engagement and disengagement when learning with digital technologies. We found that female students often display higher levels of engagement, but that there were no differences between female and male students'

behavioural disengagement. Non-native speakers refrained from unauthorised use of digital technologies to a significantly greater extent than native speakers, and while high-frequency gaming students did not use the Internet to research what others have written, as much as students reporting low-frequency gaming, we also noted that high-frequency gaming students did not report being as easily distracted by notifications nor by information overflow as much as the low frequency of gaming students.

Future work

Qualitative approaches can complement and expand our findings, to contribute further to the understanding of underlying factors that drive engagement and disengagement in TEL. It would also be of interest to approach the differences of engagement and disengagement between programmes that qualify students for higher education and vocational programmes.

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