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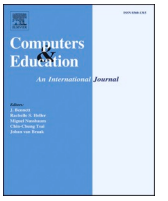

Engagement and disengagement in online learning

Nina Bergdahl [a,b,*]

[a] Halmstad University, Sweden
[b] Stockholm University, Sweden

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ABSTRACT

It can be challenging for teachers to engage students online; to know whether students are engaged or not. Online engagement can be perceived differently than in-class engagement. Research has shown that teacher perceptions of student engagement affect how they interact with students as well as students' grades. It is critical to understand how teachers perceive engagement, not least in an online setting, to inform practices and research. This study explores Swedish teachers' understanding of student online engagement and disengagement. A Mixed Method Grounded Theory study was designed as an intervention with an interview-diary-interview format. Twenty interviews with teachers (n = 10) who regularly teach hybrid, remote or distance classes in K-12 education were analysed using descriptive statistics and content analysis. The results show that teachers express understanding at the macro and micro level of engagement and would report different combinations of engagement and disengagement at different levels of engagement. The results informed an engagement model with a complex construct without inherent boundaries; teachers rated student engagement both below and above the suggested scale. The contribution to theory with included models is discussed.

Credit author statement

Nina Bergdahl has conducted all parts of the study**:** Idea, study design, conceptualisation, methodology, visualisation, writing and editing.

1. Introduction

Student engagement is closely related to attendance, grades, general well-being, and school success (Alrashidi et al., 2016; Fredricks et al., 2004) and disengagement with passivity, absenteeism, school dropout, social problems (including juvenile delinquency and substance use) (Wang & Fredricks, 2014) and subsequent challenges in adulthood (including health and career) (Grønborg, 2013; Lawson & Lawson, 2020). While students may display both proactive engagement (i.e., goal setting and planning), engagement may also be reactive (i.e., trying to "fix" what was found to be poorly functional learning strategies) (Cleary & Zimmerman, 2012). The risks of not being able to engage in learning should not be underestimated or underplayed. That engagement is critical for learning can be reflected in several reviews conducted during recent decades (e.g., Alrashidi et al., 2016; Bond, 2020; Henrie et al., 2015; Martin et al., 2020). Analyses of student engagement have been used to inform school and curriculum development (Christenson & Reschly, 2012),

* Corresponding author. Department of Education, Kristian IV:s väg 3, 301 18 Halmstad, Sweden.
E-mail addresses: Nina.bergdahl@hh.se, ninabe@dsv.su.se.

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identify disengagement and curb school dropouts (Fredricks et al., 2019; Kim et al., 2017) measure and monitor quality on teaching and the effects of school interventions (Center for Postsecondary Research, 2018; Christenson & Reschly, 2012; International Association for K-12 Online Learning, 2019) and to measure, analyse and predict students' school success (Montgomery et al., 2019; Pöysä et al., 2018). In their literature review of online teaching, Martin et al. (2020) concluded that although student engagement was the most common theme in online learning studies, the operationalisation of engagement was often inconsistent and unspecified. Several recent studies (e.g., Martin et al., 2020; Zhang et al., 2020) have identified the lack of research exploring students' engagement online and pointed out that it is critical to understand student engagement in online environments because it is unique in relation to the physical classroom and that the research that exists is mainly aimed at university students (Martin et al., 2020). Moreover, despite its negative consequences for both the individual and the school (Wang et al., 2017), students' disengagement has often remained overlooked. Research has shown that *how* teachers experience student engagement and disengagement influence their response to students; they may, for example, become ignorant or more controlling (Bergdahl & Bond, 2021; Skinner & Belmont, 1993). Against this background, the teacher is critical for students' learning (Harshbarger & Kesehatan, 2019; Hattie, 2009). A teacher in a physical classroom can work on an intervention basis to create networks and support structures for disengaged students (Fredricks et al., 2019). Still, it is not certain that such an approach can be automatically translated to online teaching, as teachers may find it challenging to support students online (Grissom et al., 2017). Several studies have proposed that teachers readily use information about students' engagement to design, adapt, and alter their in-class practice, but may feel constrained in an online setting, as engagement online is not perceived as intuitively as it is in a physical classroom (Martin et al., 2020; Zhang et al., 2020). Other studies convey that there is a lack of research on "the learning experience because engagement, social presence or social belonging are multi-dimensional concepts that are difficult to measure" (Raes et al., 2020, p. 286) and that digital pedagogy needs to be developed (Grönlund, 2020). Against this background, the presented study contributes with insights and theory development. Building on teachers' experiences of student engagement and disengagement in digital learning environments, the following research questions are raised: "How do teachers understand student engagement and disengagement when teaching takes place online?" and "How can we conceptualise engagement and disengagement building on the analysis of teacher understanding?"

2. Background

2.1. Current position in conceptualising engagement

The meta-construct of engagement and disengagement in online learning and learning in physical classrooms continue to be relevant event hough, the conceptualisation of engagement has evolved over time. Today, research contributions reflect an increased conceptual understanding of engagement which includes the situatedness of online learning. For example, engagement has been viewed as two-dimensional with affective/emotional and behavioural dimensions (Audas & Douglas Willms, 2001), a three-dimensional with affective/emotional, behavioural and cognitive dimensions (Connell & Wellborn, 1991; Fredricks et al., 2004), or smaller or greater variations to this three-dimensional labelling with other labels: vigour, dedication, and absorption (Schaufeli et al., 2002) or cognitive, academic, emotional and behavioural (Appleton et al., 2006) or extended focus to each dimension cognitive/academic, emotional and social/behavioural (Yazzie-Mintz, 2007). The operationalisation can include effort extent of participation and identification with school values (Audas & Douglas Willms, 2001), earning credits toward graduation (Christenson & Thurlow, 2016), or be viewed as attitude toward learning that may lead to proactive behaviour if disengagement (also referred to as *disaffection*) does not occur (Mosher, 1985). Skinner and Belmont (1991) suggest that engaged students (in a classroom) select tasks to expand their competencies, take the initiative, display concentration, and demonstrate intense effort in learning activities, accompanied by "enthusiasm, optimism, curiosity, and interest". On the other hand, disengagement would manifest as "not trying", passiveness and giving up in the face of challenges, along with feelings of boredom, depression, anxiety, anger, withdrawal, and rebellion (ibid. p 572). Today, there is a consensus that engagement is a multi-dimensional construct, with 2–4 dimensions (Fredricks et al., 2004; Symonds et al., 2021).

Student engagement in learning is continuously gaining interest today, spanning several disciplines. Many researchers have worked to contribute to a shared consensus of the engagement concept (e.g., Christenson & Reschly, 2012; Fredricks et al., 2004). Still, reviews have identified disparate ways of understanding and conceptualising engagement (Alrashidi et al., 2016; Boekaerts, 2016; Henrie et al., 2015). While engagement and disengagement are affected by context (Center for Postsecondary Research. Indiana University School of Education, 2018; Grønborg, 2013), both reciprocally and sequentially (Wang & Hofkens, 2019) the context is rarely included. With increasing digitalisation in education, researchers have begun to propose that engagement with digital technologies differs from in-class engagement (Bergdahl et al., 2020; Halverson, 2016; Ma et al., 2018) as digital technologies change the conditions for learning (Halverson and Graham, 2019). Moreover, how digital technologies are orchestrated to facilitate learning influences students actual lesson-to-lesson engagement and varies more between teachers than the subjects thought (Bergdahl et al., 2018). Against this background, some researchers have proposed that engagement could be approached by including the digital context when students engage in online support, communication, orientation, self-direction and a feeling of belonging (mediated through a digital learning environment) (Ma et al., 2018) or that qualitative indicators could be complemented with quantitative indicators (e.g., "time on task") (Halverson & Graham, 2019; Henrie et al., 2015) which would enable the use of platform data to explore engagement.

Furthermore, there is yet no consensus on including a fourth, social dimension to the engagement construct. Some researchers argue that there is no need for a social dimension (e.g., Symonds, et al., 2021). However, models of engagement and disengagement that include indicators reflecting behavioural, cognitive, emotional and social dimensions have been validated in recent studies (Bergdahl et al., 2020; Wang et al., 2017). Wang and colleagues also demonstrated that engagement and disengagement are related but

separate and distinct constructs, each with these four dimensions (Wang et al., 2017). It is worth noting that engagement indicators may not necessarily have a natural opposite in disengagement (Finn, 1989; Skinner et al., 2008), and if they did, it is not certain that explanatory value would be significant. Bergdahl (et al., 2020) presented an eight-factor model on engagement and disengagement and showed that indicators within social disengagement had the highest factor loadings (explanatory value) of all the disengagement dimensions. Building on student self-reports of engagement in blended learning classrooms, they propose that indicators of engagement in blended learning include:

Behavioural: Student displays proactive use of digital technologies to support learning, *or* displays unauthorised use of digital technologies.
Cognition: Student requires digital technologies to enhance cognitive abilities, easy to concentrate when working digitally, *or* experiences information overflow and getting easily distracted.
Emotional: Student relies on digital technologies, finds creating and doing homework with digital technologies satisfactory *or,* uses digital technologies to escape feelings of boredom.
Social: Student is satisfied with online feedback and perceives that digital technologies enable inclusion, participation and belonging, *or* feels isolated and left to manage digital technologies alone (Bergdahl et al., 2020).

An additional way to approach engagement is to focus on proactive (Reeve, 2012) and reactive engagement (Cleary & Zimmerman, 2012), where proactive engagement requires agency and self-regulation and reactive engagement occur as a corrective measure- and proactive engagement, when previous learning strategies (agency and self-regulation) has not led to successfully meeting student learning goals (ibid.). Engagement may also be approached at a macro or micro level, where the former approaches use general engagement (i.e., general school engagement), and the latter reflects the situation-specific engagement; the engagement that teachers can influence in practice (Symonds et al., 2021). According to Symonds (et al., 2021) most engagement research focuses on the macro level of engagement, which may be informative, but would not reflect the day-to-day, lesson-to-lesson or activity-to-activity level of engagement, but rather be an estimation of engagement thought to represent engagement over a course, a semester or a year. If these approaches do not take the context into account, comparing results may be challenging: this as online learning does not consist of one single mode of education with one set of conditions in a given time and space, but a variety of modes with synchronous and asynchronous elements that take place online as well as in-class. The current position in engagement research (according to Symonds et al., 2021) encourages researchers to: address situation-specific (micro level) engagement, explore the relationship between motivation and engagement, which to date remains unclear, and clarify the internal dynamics or interplay, the causal reactions and triggers.In addition, the relationship with disengagement is yet to be explored. To provide a fuller picture of engagement, researchers have suggested that teachers' perceptions of engagement could be explored (Wang et al., 2017).

2.2. *Influences on engagement and disengagement*

Teacher instructions and learning activities influence student engagement (Bergdahl & Bond, 2021; Heemskerk et al., 2020). Skinner and Belmont (1993) explored the reciprocal relations between teacher behaviour and student engagement and identified strong correlations between teacher structure, involvement and autonomy support on student behavioural and emotional engagement. They found that students with lower levels of engagement could receive limited support as teachers would respond negatively to students' negative emotions. Teachers may also exert control and vary in autonomy support (Jang et al., 2010). Mood, achievement, and social emotions may also influence student engagement (Pekrun & Linnenbrink-Garcia, 2012). A more recent study identified that responses between teachers differ: some teachers would express frustration, having "a certain type of students", and ignore students who displayed disengagement, while others would employ a higher work pace than their students when trying to activate them and redeem passivity in the classroom (Bergdahl & Bond, 2021). The study identified learning situations where teacher behaviour influenced a shift from disengagement to engagement and vice versa (ibid.). Notably, engagement researchers have also found that students can display engagement and disengagement simultaneously. For example, feeling bored (emotional disengagement) and doing the work anyway, (behavioural engagement) (Fredricks et al., 2019), or choosing to focus on another, perhaps more pressing school assignment in another subject, during which time engagement in the first subject will shift to disengagement (Reeve et al., 2019). While there have been suggestions that emotion can drive cognitive engagement (Pekrun, 2011) and agency (Reeve, 2013), the relationship between engagement and disengagement is not fully understood. Instead of a static set of attributes, (dis-)engagement should be understood as malleable (Fredricks et al., 2004). While some studies have indicated that digital technologies may promote student engagement (Barata et al., 2017; Gebhardt et al., 2014; Jang et al., 2010), others have identified risks with distractions and triggers of avoidance behaviour (Fox, 2018), that uses of digital technologies can lead to depression (Salmela-Aro & Read, 2017) and that students who are overly engaged risk facing burnout (Hietajärvi et al., 2019). Such findings indicate that engagement and disengagement online are complex phenomena. As described above, teachers' interpretation of student (dis-)engagement is related to their reaction. At the same time, research has suggested that teachers may struggle to interpret (dis-)engagement online: i.e., when determining whether a student activity is ongoing or not (Giovannella, Passarelli, & Persico, 2020; Raes et al., 2020).

2.3. *Modes of online learning in Sweden*

Online teaching is often used as an umbrella term when referring to internet-supported teaching and learning. This study examines teachers' views on, and understanding of student engagement and disengagement when in online learning. There are three common

online teaching and learning modes in Sweden: hybrid, distance, and remote modes. According to Raes (et al., 2021), the hybrid mode occurs when any online teaching mode is combined with teaching in the physical classroom, but hybridity could imply a combination of other modes (Nørgård, 2021). Distance learning, in this study, refers to teaching where students participate from another place than school. Remote teaching in Sweden is what is referred to in international literature as "rural and remote" teaching. However, Swedish remote education differs slightly from "rural and remote" education and can been referred to as "synchronous remote education" (Lindfors & Pettersson) to separate them more clearly. In this paper remote education refers to the type of teaching that occurs when student(s) are co-located in the school's physical classroom, and the teacher offers remote instruction from another location. Synchronous remote education is associated with initiatives to overcome hindrances related to geographical distances, sparsely populated schools, and a lack of certified teachers (The Swedish National Agency for Education, 2020b). In Sweden, regulations for online learning have been separated for remote and distance education (The School Act Skollagen, 2010, 1, 3§), where primary and secondary schools are gradually allowed increased opportunities to offer online education (The Swedish National Agency for Education, 2020a, 2020b, 2020c). This indicates that online education is expanding towards becoming a more standardised education mode. The online expansion may follow a similar development, as noted in international distance education for adults, which have become one of the leading industries (Bawa, 2016). As described above, Symonds et al., (2021) discussed the need for researchers to explore momentary engagement. According to the research, momentary engagement reflects situation-specific engagement. However, current conceptualisations seem either to be at a macro level (ibid.) or unidimensional (overlooking how engagement may be perceived in different modes) (Henrie, 2016; Henrie et al., 2015), or at the micro level (which may include indicators that only partially reflect the digital context, or may have limited theoretical foundation). This development leads to an unnecessary growing division of how engagement is treated. While this paper by no means endeavours to provide answers to all these aspects, this empirical study touches on these tensions as it explores how teachers experience engagement in online learning by linking the findings to the educational mode and the knowledge in the field.

3. Methodology

3.1. Research design

This study applies a form of Grounded Theory (GT), which involves a mixed-methods approach (Creswell & Clark, 2011) and is referred to as Mixed Methods Grounded Theory (MMGT) (Guetterman et al., 2019). This is an exploratory, investigative study (ibid.), designed as follows: an in-depth interview was followed by (2–3 weeks of) diary reflections of teaching practises and a second follow-up interview.

3.2. Participants and context

Purposive sampling was employed (Denscombe, 2014). The study was conducted within an Ifous research and development program in Sweden, where process leaders and principals from eight municipalities were involved. From these municipalities, ten teachers agreed to participate in the study, which represented K-12 education in five municipalities: Gotland, Pajala, Storuman, Torsås and Värmdö (see Table 1). In this study, elementary school students were in grades 5–9 and upper secondary school students were in grades 10–12.

Table 1
Demographic background.

Gender	Subject	School year	Years teaching	Mode	Class-size	No. Students/ lesson	Int. 1 (min)	Int. 2 (min)	Tot. Int. (min)
Woman	Health and social care	Upper secondary	3	Remote	26	4/3	83	45	128
Woman	Foreign languages	Elementary	22	Remote	8	4/3	48	30	78
Woman	Foreign languages	Elementary	10	Remote	9	4/3	57	45	102
Man	Mathematics, physics	Upper secondary	23	Hybrid	7	4/3	45	40	85
Woman	Native language	Upper secondary	5	Remote	3	3/3	90	35	125
Man	Natural sciences	Elementary	20	Hybrid	16	4/3	75	35	110
Man	Psychology	Upper secondary	13	Hybrid	15	4/2	57	48	105
Woman	Swedish language	Upper secondary	2,5	Distance	8	4/3	68	32	100
Woman	Social sciences	Upper secondary	15	Distance	6	4/2	48	32	80
Woman	Foreign languages	Upper secondary	16	Distance	13	3/3	77	55	132

3.3. Data collection and analysis

Even though qualitative data was collected (Guetterman et al., 2015), there were both quantitative and qualitative approaches to data analysis (see section 3.4) (GT is commonly associated with a strict inductive approach). It is recognised that while an inductive approach is in the foreground, deductive elements are included (Gilgun, 2015; 2019). Developing GT, Glaser and Strauss suggested that for the data to have any meaning and to be able to generate theory, deductive processes that include researcher insights and perspectives are required (Gilgun, 2019; Glaser & Strauss, 1967). Glaser and Strauss emphasised that researchers need an understanding to "see relevant data and abstract significant categories from his [sic]scrutiny of the data" (Glaser and Strauss (1967:3). Building on Glaser and Strauss's theory and reasoning and her extensive GT research, Gilgun concludes that there are both inductive and deductive processes in GT (Gilgun, 2015; 2019). However, Gilgun stresses that when adopting inductive and deductive processes, the relationship between the known and the unknown needs to be transparent (Gilgun, 2019).

Following the recommendations of Gilgun (2019), Table 2 reflects the adoption of inductive and deductive approaches and reveals that the inductive approach relies on specific deduction elements. For example, before commencing the study, there is an understanding of teaching practices, engagement, and disengagement phenomenon that informed the diary layout and interviews.

3.3.1. Interviews and diaries

All interviews were conducted via Zoom and recorded. The recorded material amounted to 21.5 h (1045 min), where interviews (1st set) varied between 45 and 90 min (a total of 648 recorded minutes), and interviews (2nd set) varied between 40 and 50 min (a total of 397 recorded minutes). To enable deeper dialogue, Interview 1 was combined with a dialogical technique used to listen and guide the teacher further in his exploration of engagement and disengagement (Martin et al., 2020) by, for example, asking: "Do you think that engagement is also collective?" or in response to questions from respondents such as "To answer that, I need to understand what is meant by disengagement." An interview template was used (see Appendix A), and memos were written throughout the data collection and analysis process. During Interview 1, teachers were also asked to report on their students' ($n = 108$) general engagement using their class record (see Appendix B), and a 1–5 scale (where 1 equals "not engaged at all", and 5 equals "always highly engaged"). All teachers were asked to keep a diary on engagement in and disengagement from learning, focusing on 2–4 randomly selected students, over 2–4 lessons (in total, teachers reflected on 46 students over 34 lessons) (see Appendix D). If one student was absent, the teacher was asked to move to the next one on the list. The diaries were not collected but used as mental support for teachers to systematically approach student situation-specific engagement and functioned as a foundation for reflection during the second interview.

3.3.2. Analysis

The analysis process began with organising the data in online and physical folders (by chronology). Subsequently, a familiarisation and exploration process of re-watching and transcribing the meetings were undertaken (Gilbert et al., 2014). The transcribed interviews were coded using NVIVO 11.4.3 (Payne, 2016), and teachers' estimations of general student engagement were collated in MS Excel version 16.56 and analysed using descriptive statistics. The initial coding meant that data was coded and grouped in semantically similar categories. Memos were used to note reflections and inform additional queries for the second interview. Data collection, transcription and coding were conducted in parallel. All recordings from Interview 1 were transcribed and initially coded by the author before the second round of interviews commenced. The coding shifted from open to more focused coding as categories emerged while adopting constant comparison (Glaser & Strauss, 1967; Payne, 2016). Theoretical sensitivity was applied (Charmaz & Thornberg, 2021). This means that when coding the data, e.g., "Student adopted a wait-and-see attitude [emotional], provided long sequences of reasoning and well-founded analysis [cognitive], had done the homework and was well-informed [behavioural], and invited peers [social]" (J2), the four-dimensional conceptualisation (Wang et al., 2107) was found to be suitable. While the theory could be suitable for explaining some of the data and could function as a foundation for further theory development, this position remained tentative (Charmaz & Thornberg, 2021). While Interview 1 included broader questions (e.g., "Can you describe the events that led to the disengagement or preceded the disengagement?", "What helps you to deal with disengagement?"), the first set of interviews was transcribed in full. After coding Interview 1, the research questions were refined into their current state (ibid.). The second set of interviews was then transcribed in relation to what was essential for the research questions (Payne, 2016). As results should not comprise of unrelated but interesting findings, a selected emphasis was employed (ibid.). The coding process is best described as an iterative rather than a linear process, going back and forth, and exploring the links between codes and memos. Last, quantified measures from NVivo were extracted and analysed using descriptive statistics.

Table 2
Adoption of induction and deduction.

Approach	Respondent diary design	Interview	Data analysis
Inductive	Open headings and room for additional reflections allowed for emerging interpretations.	Effort to discard previous knowledge during interview. Literature review conducted after analysis.	Respondent informed engagement quality and indicators within dimensions. Data to inform theory.
Deductive	Experience and insights of (dis-) engagement and informed the layout of the diary.	Researcher answers direct questions ($n = 2$) from teachers in relation to (dis-) engagement.	Using existing engagement dimensions to categories initial analysis and identify ideas that challenge existing theory.

3.4. Ethics

Written consent was obtained from all respondents before the study began. The respondents were informed about the study, what data that was to be collected, how data was to be used, and their right to withdraw their consent. Pseudonyms without ethnic signs were used throughout, for example, for teachers: A, B, C, interviews: 1, 2, 3.

3.5. Validity

According to Kafle (2013), validity in the qualitative approach refers to fullness and depth. Fullness is the richness that reflects how meaning has been contextualised and conveyed as experienced by the respondents, and depth refers to the researcher's ability to identify the essence of the expressed intention of the respondents. To ensure that the interpreted meaning has validity, it was confirmed whether the respondents' expressions were correctly understood during the interview. During the interview, interpretations were continuously summarised to the respondents for momentary validation (Payne, 2016). This qualitative form of validation is necessary because the respondents know best what is intended (Kafle, 2013).

4. Results

The first research question, "How do teachers understand student engagement and disengagement when teaching takes place online?" is answered in sections: 4.1–4.5 with respondent quotes presented in Appendix D. The second research question "How can we conceptualise engagement and disengagement building on the analysis of teacher understanding?" is answered in section 4.4 (also see Figs. 2 and 3). As conditions for learning online are related to the educational mode, the result section starts by describing how education modes were enacted.

4.1. Modes of education

All teachers were asked to describe their teaching practices. Results reveal that distance education (which traditionally is mainly asynchronous) often included optional and compulsory synchronous lessons (J1, K1, L1). Teachers described remote teaching as teaching students who were gathered in one (B1, C1) or several other (A1) school(s), although they would accept students logging in from elsewhere too (B1, D1). In addition, some teachers included students from different age groups (C1, D1) in the same lesson or course. Also, teachers describe teaching remote and distance classes simultaneously (D1, G1). The combined teaching of co-located and online students is interpreted as a hybrid mode.

4.2. How teachers experience macro level online engagement

Teachers were asked to select a class and estimate all students' general engagement in learning (see class-size Table 1) without further instructions on how to estimate engagement. The results show that teachers have an idea of students' general engagement in learning (see Fig. 1).

Teachers rated student engagement levels on a 1–5 scale, (where 1 is low and 5 is high).

Teachers described that they have students across all engagement levels 1–5, with more students highly engaged (4–5) than with low/little engagement (1–2). These estimated levels of engagement reflect a general (macro level) perception of engagement which is not specific to any situation. The estimation was done with relative simplicity (only one teacher suggested a level between "3 and 4" (see Appendix B). This indicates that teachers are familiar with the concept of engagement and have a general understanding of student engagement in learning, even if learning takes place online. The teachers also reported that (the macro level of) engagement was relatively stable. During the intervention, several teachers started questioning their previous perceptions of student engagement. How teachers developed their understanding is explored and published elsewhere (Bergdahl, 2022).

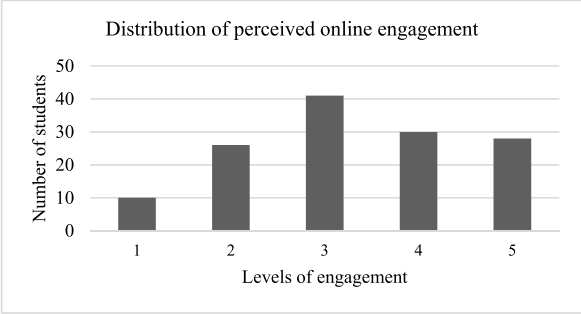

Fig. 1. Teacher perception of student engagement online.

4.2.1. Estimating engagement is primarily an emotional, not a cognitive challenge

Although teachers could make an overall assessment, three teachers expressed strong emotions, empathy for the student and feelings of frustration when addressing student engagement and disengagement (see Appendix D). Engagement and disengagement may include social phobia, performance anxiety, isolation, and feelings of exclusion. The difficulties in estimating engagement stemmed from feelings of discomfort rather than a lack of perception of student engagement and disengagement.

4.3. How teachers experience micro level online engagement

When asked to describe student online engagement, teachers would report on combinations of engagement dimensions. However, they would also include qualitative aspects such as the activity grade, whether students were doing their best, demonstrating accumulative knowledge, their history of attendance, and autonomous/self-directed. Teachers also reported that their perception of student work pace and immediacy influenced their perception of student engagement. These aspects are becoming relevant as teachers report levels of engagement outside the 1-5 scale, as described below. Figs. 2–6 demonstrate the combinations of dimensions for each level. The following abbreviations are used: Beh, Cog, Emo, and Soc for behavioural, cognitive, emotional, and social dimensions of engagement. D is used to indicate disengagement. A coding matrix demonstrating the number of utterances across educational modes and school years is provided in Table 3 (Appendix D).

4.3.1. Levels 0-1

At the lowest levels, the student was described as absent (DBeh) either at level 0 (2 teachers) or level 1 (2 teachers). That younger learners could forget that they should focus "on the person in the screen" and walk away was the main difference between elementary and post-secondary students. Level 0 was characterised by combinations of disengagement, DBeh-DCog (absenteeism due to prioritising engagement elsewhere or not seeing the relevance of education), DBeh-DCog-DEmo-DSoc (a wider account of factors hindering engagement). One plausible explanation for teacher reports on student absenteeism is that it is likely to vary in relation to how well the teacher knows the students' circumstances and shares those during the interview. Level 1 was characterised as requiring presence as the only engagement indicator, often combined with disengagement. Thus, behavioural engagement was often combined with behavioural or cognitive disengagement (i.e., Beh-DCog; Beh-DBeh-DCog).

While level 1 students were characterised as having an engagement influenced either by distraction (behavioural presence but disengage behaviourally and cognitively by actively choosing to, for example, engage in unauthorised uses of digital technologies) or social struggles, there were also the students who needed constant nudges to work (B1), or who worked more slowly than the others (C2).

4.3.2. Levels 2-3

In levels 2 to 3, there is an increasing number of nodes (and combinations) where engagement and disengagement co-occur (see Figs. 2 and 3). Here teachers start reporting on accumulative aspects that influence their perception and estimation of student engagement. Accumulated cognition (Cog [Ack] in Fig. 3) reflects the knowledge on the subject that the student masters. The accumulated behavioural disengagement (skipping class), refers to students' history of truancy and absenteeism (DBeh [Ack] in Fig. 3). An interesting point (but only noted by one teacher) was that social engagement with the teacher was not always perceived as positive but instead interpreted as a lack of self-direction or autonomy when the students were expected to have understood the instruction. Thus, not all social engagement is perceived as positive by teachers (for more examples, see level 5). In level 2, social disengagement co-occured with social engagement.

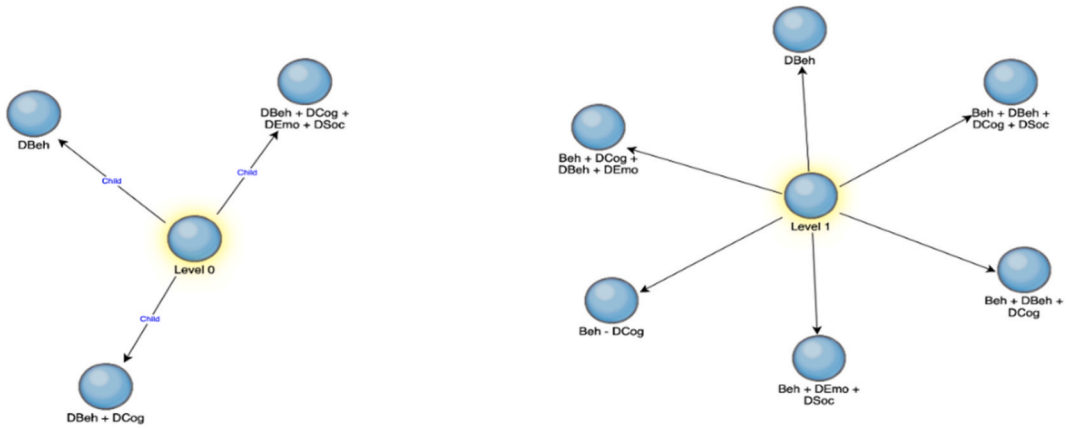

Fig. 2. Nodes connected to level 0 and level 1. The nodes reflect teacher utterances of engagement and disengagement in the various levels.

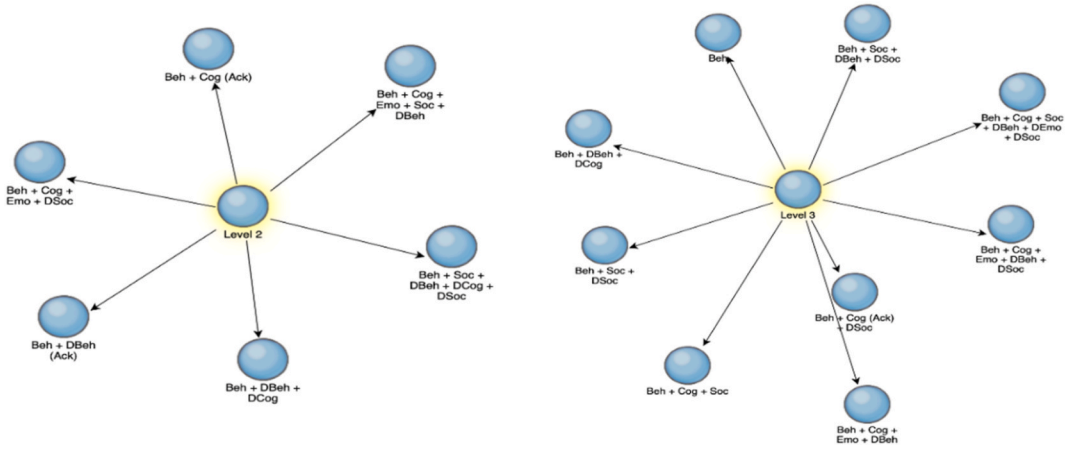

Fig. 3. Nods connected to level 2 and level 3.

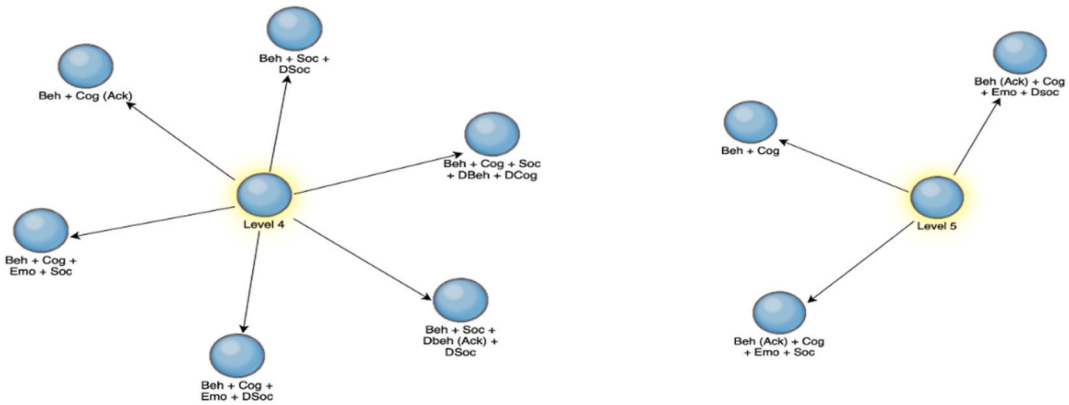

Fig. 4. Nods connected to level 4 and level 5.

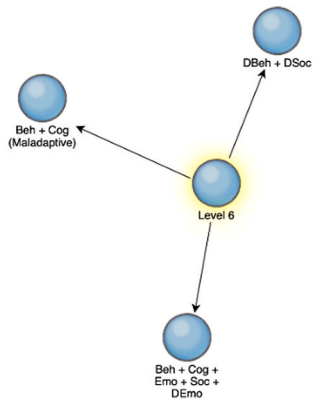

Fig. 5. Nods connected to level 6.

4.3.3. Levels 4-5

When describing level 4, teachers included immediacy, dedication beyond what was expected and the quality of production as something influencing their perception of engagement. Social insecurities continue to separate students in relation to their momentary engagement but would not affect teachers' estimated level of engagement.

Nevertheless, there can also be differences in student social engagement when peers and teachers are involved. Social engagement and social disengagement co-occured through levels 1–5. One aspect affecting social engagement was the conditions for interacting

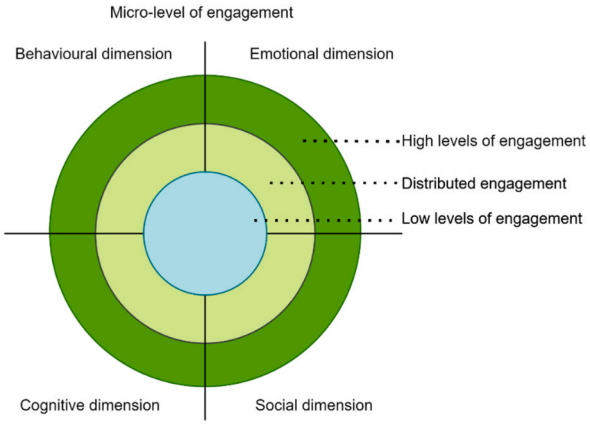

Fig. 6. Model 1: Engagement layers (model viewed from above).

online.

4.3.4. Level 6

Level 0 and level 6 both display a few (three) nodes. These range from maladaptive levels of behaviour and cognition to high levels of all four dimensions with emotional disengagement where the student is driven by self-critique and anxiety, and fails to recognise their own effort.

In one case, the teacher reported that before disengaging, the student had halted the schoolwork (behavioural disengagement) and informed the school via a representative that s/he now were too ill to pursue a degree (social withdrawal not only from peers but also fully from teacher; social disengagement).

4.3.5. Engagement without inherent boundaries

Teachers described that engagement may go beyond what is needed to pass a course. Some teachers said that their demands could be unhealthy and that their stress could be passed on to the students, even though they knew that this could be unhealthy (L1). The teachers did not only rate the general engagement on a 1-5 scale. They used the diaries to continue their reflections and rate the level of engagement. During the follow-up interview, teachers were asked to describe the student engagement for each level. Despite this instruction, several teachers described engagement at both level 0 and level 6. Several teachers described engagement as relatively stable. They also reported how a student at level 6 due to burn out may end up at level 0. Students with engagement at level 0 were thought of as students with whom it was impossible to get in touch. When students who were estimated to display engagement at level 0 returned to school, teachers stated they enter the level of engagement that they had been on previously. (See also description levels 5 and 6).

4.4. Engagement is a complex phenomenon with reciprocal and contextual influences

When focusing on the situation-specific engagement, teachers would provide indicators of both engagement and disengagement at an estimated level of engagement. This enrichens the understanding of how engagement and disengagement can occur simultaneously (cf. Fredricks et al., 2019; Reeve et al., 2019). Results reveal that in online education, it is not only the consequences of engagement (i.e., results) that form teachers' understanding.

4.4.1. Complex relationships between and within dimensions and individuals

Students can display engagement and disengagement simultaneously (see Figs. 2–5). However, with, for example, social engagement and disengagement, teachers reported a level of acceptance. They prioritised behavioural engagement (making the effort to complete the task) and accepted social disengagement (not interacting with peers). Teachers reported that when the demands on social engagement trigger negative emotions, social engagement could shift to disengagement (L1). Interestingly, the lower levels of engagement indicators often reflected a need for social engagement. It was also through social engagement with the student that the teacher sought to, and found it successful to, redeem disengagement.

Conversely, the indicators that the teachers reported on at level 6 all relate to the emotional dimensions. But, successful interactions to redeem this high level of engagement was not identified. Moreover, when teachers report on engagement at level five, they also reported on negative signals: that students can become bossy, demanding and complaining. Teachers reported that the social dimension was seen when students actively sought contact with the teacher and were active in group work, and in break out rooms; that the student contributed to positive learning climate, invited others, and waited for his/her turn, *or* withdrew from peers and school, became truant or absent.The teacher could also experience difficulties in establishing contact; the student may not respond during class or via email and display social difficulties in interaction with other students. Teachers reported that social interaction with

peers is a goal but that social interaction with the teacher is a good start.

4.5. The theory with included models

When teachers reported on students' general engagement (macro level), they noted that engagement was relatively stable for most students. At the micro level, teachers reported on context-dependent fluctuations (related to having access to useable technologies, the student's mood, the grouping of peers, design of learning activity and interest), and students dropping out at level 0 due to health-related reasons, to reengage at their previous engagement level. Building on the results of teachers' understanding of student engagement online and matching these with existing engagement theory; student engagement online can be conceptualised using a four-dimensional conceptualisation, where engagement and disengagement are distinct and separate constructs with layers (reflecting high and low levels of engagement), with inter-and intra-related influences where engagement and disengagement may co-occur.

4.5.1. A multi-layered construct

Engagement can be viewed as a multi-layered construct, reflecting layers within a momentary engagement. The multiple layers of engagement (and disengagement, respectively) are visualised in Figs. 6 and 7.

Each circle symbolises a layer, and all four dimensions have (*here*) three layers each. It is suggested that engagement, which is situation-specific, proactive, and reactive to external influence, decreases as we remove the circles. These layers are as follows: The outer circle (high levels of engagement), could be reflected as immediacy and responsiveness. For example, students could be well-prepared having their material, having done their homework (behaviour) and exert the effort to master the subject, stay focused (cognition), display curiosity and aptitude to learn (emotional) and invite peers to share their reflections and contribute to a positive learning climate (social). The middle circle (distributed engagement, which can be ambivalent, fragmented, and shallow)can be described as students engaging in unauthorised mobile phone use (behaviour) which can lead to split or fragmented attention (cognition). Students may also feel socially insecure (emotion) and switch off their camera to withdraw socially (even though cognitively and behaviourally engaged). Finally, the inner circle (low levels of engagement), which refers to the lack of qualitative aspects. Teachers describe these as not putting in any effort (cognition), leaving class (behaviour); a lack of enthusiasm, arousal or drive to initiate work (emotion). Not asking for help and uncommunicated absence (social). In the lowest levels of engagement, there may be a desire to engage (the student no longer takes part in the teaching and learning and may have transferred their engagement and be fully engaged in something else). This theory assumes that all students have the ability to engage fully in the absence of triggers.

4.5.2. Intra- and interdimensional influences

Model 2 (below) reflects engagement and disengagement as two separate but parallel constructs. By reducing the brightness of colours in the model, it is suggested that the engagement/disengagement dimension in that section is inactive (i.e., it exists but is currently not active). The difference between inactive and active engagement is that students have access to engagement in that dimension, but it is not displaying it (e.g., in turn-taking, students would observe other students talk or pause to reflect).

The pause does not suggest disengagement, but it recognises that there are situations where full engagement is not constantly demonstrated as observable indicators across all dimensions. It is hypothesised that when all disengagement dimensions are activated that all engagement dimensions are inactive. And that even though indicators of engagement and disengagement mya co-occur, full engagement and full disengagement cannot. How many disengagement dimensions that are active when students risk school failure remains to be explored.

Model 2 suggests that when disengagement is triggered (A, B), engagement decreases (C) (visualised in Fig. 7). In the model, A is a reaction to external influence, and B is a consequence of the activated A. Example 1: the student has a camera on in a video-conference meeting, and uncomfortable feelings are triggered (A). The behavioural disengagement is triggered as the student responds by turning the camera and screen off. Then the student only hears the teacher and peers. The emotional engagement (B) is then reduced as the

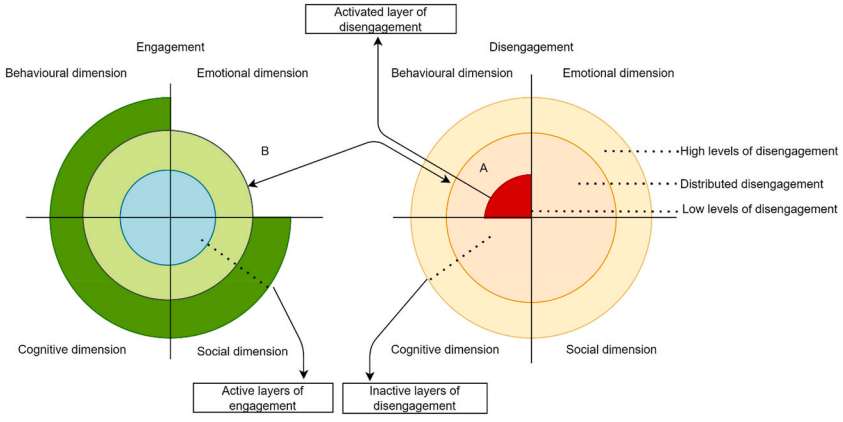

Fig. 7. Model 2: Inter-dimensional influences (model viewed from above).

student feels less connected (and less affected). Combinations of engagement and disengagement dimensions can, however, be more complex (see Figs. 2–5). Example 2: In level 4: Beh-Soc-DSoc (see Fig. 4), the student would be present (behavioural dimension is activated) and communicate with the teacher using facial expressions (social dimension activated) but refrain from talking (social disengagement activated). When social disengagement is activated, social engagement is reduced. Thinking that deactivating social disengagement may increase social engagement, can be a plausible explanation to teachers social engagement. However, such interventions should also be informed by an understanding of emotional, behavioural and cognitive triggers.

5. Discussion

This section discussed the research questions: "How do teachers understand student engagement and disengagement when teaching takes place online?" and "How can we conceptualise engagement and disengagement building on teachers' understanding?"

At a macro level, teachers would, with relative ease, report on students' general engagement in online learning using a 1–5 scale. However, when presented with a diary and asked to focus on a smaller number of students across lessons, in which teachers were asked to repeat their estimation of engagement at the micro level, teachers reported that engagement did not have inherent boundaries. For example, students who did not attend class were estimated to display engagement at level 0, and extremely engaged students were estimated to display engagement at level 6. An absent student estimated at level 0 could re-enter at their "normal" level of engagement. This indicates that the engagement construct has high- and low levels (reflected as multiplelayers in the model). Using the four-dimensional construct, the model, in the shape of a circle, was divided into four equally sized sections, with an outer, a middle and an inner section. High engagement levels are reflected when the three sections are active, and lower levels are reflected when sections are inactive. The intensity of engagement may be reflected in qualitative aspects as has been described by engagement theorists as " … simply doing the work and following the rules to participate in the student council. Emotional engagement can range from simple liking to deep valuing of, or identification with, the institution. Cognitive engagement can range from simple memorisation to the use of self-regulated learning strategies that promote deep understanding and expertise" (Fredricks et al., 2004, p. 61). Teachers reported that specific and different dimensions of engagement and disengagement that could be influenced would co-occur at different levels. At the lower levels, teachers would report that it was mainly the social disengagement that prevented engagement (e.g., social insecurity, withdrawal, social anxiety). At the higher levels, emotional disengagement was seen to prevent engagement (e.g., having high demands on oneself, being an overachiever, not feeling content with one's production, worry). Skinner and Belmont (1993) suggested that engagement could be viewed as a unidimensional scale with high and low levels, where low levels reflected disengagement (disaffection). Wang et al. (2017) presented engagement and disengagement as two interrelated constructs. The complexity of the combinations of engagement and disengagement, and the qualitative aspects have not been captured in a model prior to this study. The results here shows how indicators of engagement and disengagement are reported to co-occur across engagement levels. Thus, this study proposes a combination of the two appraoaches: that engagement and disengagement are distinct and separate and have qualitative aspects in terms of high and low levels of engagement. This is reflected in the multi-layered models, i.e., there are high and low levels in the activated indicators in a dimension, that different dimensions can be activated when different levels of engagement are displayed. Results also reveal that specific combinations of engagement and disengagement are likely to be more common at different levels of engagement. Moreover, engagement and disengagement affect each other, between and within engagement dimensions and in relation to the context (for example, having the possibility to turn the camera off, made it possible to engage behaviourally and cognitively).

The presented models support previously forwarded ideas of reactive engagement, which also can be linked to Cleary and Zimmerman's (2012) idea of contextual reactions as well as proactive and agentic engagement (Reeve et al., 2012) and includes the micro perspective (Symonds et al., 2021). Symonds (ibid.) discussed if the social dimension should be treated as an engagement dimension or viewed as a part of the context within which engagement occurs. This study acknowledges that learning is social (Lave & Wenger, 1991), takes place in a social world (Bhaskar, 2013), and that social withdrawal is an indicator of disengagement (Finn, 1989; Finn & Cox, 1992; Scanlon et al., 2020). This study expands on the findings of Wang (et al., 2017) and Bergdahl (et al., 2020) and proposes that students with social insecurities (including social phobia) display engagement differently than students with no social insecurities. For example, teachers in the presented study posit that students with social phobia are engaged in learning but refrain from social engagement with peers. These students were reported to not only engage differently than students who readily interact with peers, talk in class, and present their assignments, but also caused more problems for teachers, in terms of how to work around these hindrances. Moreover, teachers reported that their social engagement with socially disengaged students could redeem social disengagement. This indicates that a social reality in which social practices exist may include social (dis-)engagement indicators. As brought up, Symonds et al., (2021) proposed that the internal dynamics, causes, reactions and triggers need to be clarified. Symonds et al., reflect that "students' momentary engagement in a task is marked by non-linear reactions and pro-actions to internal (e.g., rising and falling fatigue, interest, hunger) and external (e.g., peer comments, teacher instructions) events" (ibid. 14–15). The findings here are similar but also propose that different engagement indicators are more common at different levels of engagement. Furthermore, combinations of engagement and disengagement co-occur differently across these levels. Expanding on these thoughts and building on the in-depth interviews and diaries, it is suggested that online (dis-)engagement is perceived as consisting of multiple layers and that the micro level of engagement is reactive and therefore directly subject to contextual influences. Further research on how these dimensions and layers interplay and how layers are influenced is needed. Finally, results indicate that engagement lacks inherent boundaries. In line with previous research which has put forward that students may be overly engaged and, as a consequence face burnout, (Hietajärvi et al., 2019; Salmela-Aro et al., 2017; Salmela-Aro & Read, 2017), the presented results suggest that unhealthy engagement exists among teachers as well as students. Engagement norms in school and families can influence the students' self-regulation and engagement

level, why more knowledge and insights on healthy levels of engagement are needed in schools.

5.1. Impact of educational mode

Expanding on previous engagement research in the K-12 setting which highlights interaction, participation and accountability as critical engagement indicators (e.g., Bergdahl & Bond, 2021; Bond et al., 2021; Curtis & Werth, 2015), this study differentiates between synchronous and asynchronous teaching and learning. While one could expect that students in distance education need a high level of cognitive engagement with agency, autonomy, and self-regulation, given the need to be self-directed, this assumes that distance education is fully asynchronous. In line with Nørgård (2021), it was found that there is an increased blurring of boundaries between the distance and physical modes of education as all of the teachers, across their educational modes, included synchronous elements. Adopting synchronous elements, teachers reported on perceived social engagement in terms of verbal and written communication, interaction and collaboration in real-time. While the teacher-student communication was mediated via technologies, this did not seem to impede teachers to form a perception of engagement as much as teachers' perception when reporting on engagement in asynchronous elements. In asynchronous elements teachers' perception of engagement was informed by students' progress, results and asynchronous responsiveness in platforms and via email. Teachers reported a more nuanced understanding of engagement when synchronous and asynchronous elements were combined.

5.2. Implications

This study found that teachers sympathise with disengaged students but were ill-informed of effective interventions. It was also easier for all teachers to describe engagement than disengagement. Nuancing, the findings of Skinner and Belmont (1993), several teachers displayed a protective reaction when asked to estimate their students' engagement. However, before teachers can be expected to support students with maladaptive levels of engagement and how they may design for engagement, they require insights on how to influence engagement and disengagement. This is particularly important as many of the students who actively apply for online education may bring with them prior experiences of school failure.

5.3. Limitations

The first limitation is the number of respondents. However, the qualitative findings that explore the phenomena through in-depth studies of a phenomenon can contribute to theory formation. Second, because there are differences between educational modes and because the respondents all included synchronous elements, the study does not convey perceived engagement in asynchronous settings. Further research should test the theory with other respondents and settings (see future research).

5.4. Future research

More research is needed to explore and validate the developed models and theory. It is hypothesised that when all disengagement dimensions are activated that all engagement dimensions are inactive. Additional approaches may include sensors, response systems or LMS data and can, for example, inspire and inform interventions in practical research or collegial development initiatives. For example: What step-by-step phases can be implemented to (inform teacher teams) and scaffold students on level 6 (facing burnout, before dropout is a fact)? Such interventions could support the development of self-regulation, teacher-student support strategies and student autonomy, all critical for engagement (Gareau et al., 2019; Jang et al., 2010, 2016; Wigfield et al., 2018) and could also contribute to validate and nuance the reciprocity between engagement and disengagement. Second, it may be inferred that the outer layer of (dis-)engagement can be understood as a situation-specific reactive layer. Reactive engagement can be linked to Cleary and Zimmerman's (2012) idea of contextual reactions, which can be both positive and negative for learning (reactive and proactive). Before it shifts to full disengagement, it is proposed that engagement transfers through a second (middle) layer. The hypothesised middle layer needs to be studied further. Future research may also explore teachers' instruction, interaction, design concerning their perception of micro level (dis-)engagement. Third, if well-being in school is a priority: unhealthy engagement needs further exploration, particularly the effects of contextual influences and culture for both teachers and students. In addition, on a higher abstraction level, it is pertinent to talk about how engagement can gain recognition in the governance, and evaluation of (*here*) Swedish education, and included in national evaluations of interventions and schools, as done elsewhere (e.g., Center for Postsecondary Research. Indiana University School of Education, 2018). Finally, further exploration of engagement in synchronous and asynchronous settings need to be further explored to understand how these influence student engagement.

6. Conclusion

The study explored how teachers who regularly teach online (hybrid, distance or remote) perceive student engagement in learning. It was found that even though online learning demands teachers to use digital technologies to mediate non-verbal and verbal communication, teachers would provide a nuanced account of student engagement in learning. Thus, the educational mode per se did not prevent teachers from perceiving engagement. However, it was found that the inclusion of synchronous elements supported teachers to report on momentary student engagement. Building on interviews and engagement diaries, these key findings were identified:

- Engagement seems to lack inherent boundaries.
- Several instances of engagement and disengagement co-occur in complex patterns.
- Engagement and disengagement are influenced within and between dimensions and by context.
- Engagement and disengagement are separate constructs, which at a macro level can be described as high and low levels, and at the micro level display different active engagement indicators between the levels.

Conclusively, this study is a first step to understanding the co-occurrence of student engagement and disengagement in remote, distance and hybrid environments. The study presents models which reflect an initial contribution to theory, where engagement is understood as multi-layered with inter-and intra-dimensional influences.

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Declaration of competing interest

The author reports having no conflict of interest.

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Appendix A. Interview template

(All appendices are translated from Swedish to English by the author).

Interview 1

What subject(s) do you teach?
Do you view your teaching as distance, hybrid, or remote teaching?
Describe your lesson structures.
Describe how the role of digital tools has changed your way of teaching since you started.
How many years have you been doing distance or distance learning?
What grade are the students you have in mind now?
About distance education: How many different schools are represented by the students in your classes?
Think of a class or group of students that you teach online.
Tell us about a situation when the students were particularly engaged?
When, if at all, did you first experience disengagement?
Can you describe the events that led to the disengagement or preceded the disengagement?
What contributed to the disengagement?
Estimate student engagement 1–5 - according to the list.
What makes you feel that the engagement, online, is at that level?
What do you feel are the challenges of seeing engagement/disengagement online?
Can teachers influence engagement/disengagement for learning? How?
What, if anything, did you know about engagement and disengagement from teacher education or continuing education? What recommendations would you give to a student-teacher in relation to engagement and disengagement in online teaching?
What helps you deal with disengagement - what problems can you encounter? Can you tell us what resources you use to fix these problems?
Is there anything you want to add?

Interview 2

What has the focus time meant? Have your understanding/experience/reflections on (dis-)engagement changed, or is it the same?
Feedback and in-depth questions from themes and memos of preliminary transcription.
Start by describing the lesson design for the observed lessons - sort by the student and describe student engagement/disengagement and the interactions that you have observed.
How does the teacher now think about engagement/disengagement (online)?
What level of engagement is needed to succeed? Is there an optimal level?
Is there anything else you think I should know to understand better?
Is there anything you want to ask me?

Appendix B. Sample of Reflection diary: student engagement

Interaction with you as a teacher:

Video-assisted interaction	Verbal interaction (camera off)	Written interaction only
Students 2, 7 and 8 attended a real-time seminar Student no. 2 - Engagement 5 Student no. 7 - Engagement 5 Student no. 8 - Engagement 3	–	Student 2: Contact via chat 17/3. The student has missed submitting an assignment from the previous week and will contact me via chat to tell me that it will be received soon.

Interaction with other students:

Video-assisted interaction	Verbal interaction (camera off)	Written interaction only
Students 2, 7 and 8 attended a real-time seminar Student no. 2 - Engagement 5 Student no. 7 - Engagement 3–4 Student no.8 - Engagement 2	–	–

Interaction with lesson content:

Video-assisted interaction	Verbal interaction (camera off)	Written interaction only
Students 2, 7 and 8 attended a real-time seminar. Content: Drama analysis from a class and feminism perspective	–	–

Interaction with lesson content:

Digital (e.g., interactive, immersive learning)	Digital (digital production)	Digital (physical production)
	–	–

Appendix C. Teacher descriptions of online engagement

Teacher descriptions of online engagement

Level 0 Educational mode	
No contact established a) The teacher has never met the student. The student is just a name on the list.	Hybrid mode
Balancing other demands b) The student self-regulates and prioritises something else actively.	Hybrid mode
No relevance c) The student does not see the necessity or relevance of the course.	Hybrid mode
Absence (legitimate) d) The student is on sick leave.	Distance mode
Level 1	
Contact challenges (during class) a) It is difficult to establish contact. The student does not turn the camera on. The student chooses not to reply.	Hybrid mode
Scaffolding and support b) The student has difficulties getting started. Will work with a supervisor/teacher assistant to support them.	Remote mode
Contact challenges (general) c) The student is difficult to reach. Often does not respond to emails.	Distance mode
Responsibility d) The student has forgotten the computer at home. The teacher perceives that the student does not want to participate.	Remote mode
Passivity and withdrawal (from teacher) e) The student is passive, does not ask for help, slower than the others, but the work gets done.	Remote mode
Passivity and withdrawal (from peers) f) The student withdraws. Refrains from addressing issues, asking for help, or expressing themselves amongst other students.	Hybrid mode
Reduced social interaction (still verbal) g) The student agrees with peers, but do not contribute with their point of view.	Distance mode
Reduced social interaction (writing) h) The student was there but did not engage or was prevented to. No oral interaction, but some written interaction.	Distance mode
Level 2	
Absenteeism and avoidance The student is not always in class. If the student arrives, they might not bring their computer. Often answers, "I do not know".	Distance mode Remote mode
Language deficiencies b) The student displays difficulty interpreting tasks.	Remote mode Hybrid mode
Focus c) The student is doing other things than learning. The student is present but not engaged.	Distance mode
Ambiguous engagement d) The student is behind and late with assignments, may disappear from the lesson, but has not disengaged from school. The student communicates and can take the initiative in class.	Distance mode
No camera 1) The student does not have the camera on at the start of the lesson but switches on when prompted.	Remote mode
Slow progression of work f) The student works more slowly than other students and may have more difficulty interpreting tasks.	Remote/hybrid mode
Unprepared and unfocused g) The student zooms out or is passing time and is not able to participate in classroom discussion.	Distance mode
Prompts to interact (writing) h) The student comments and answers questions in writing	Distance mode Remote mode
Level 3	
Social difficulties a) The student has a social phobia – participates in the lesson but is not socially active.	Hybrid mode
Autonomy and in-class engagement b) The student participates in the lessons. Always takes care of the submission. Does not seek contact between lessons.	Distance mode
Effort to learn c) They always do their best. They may not always say much at the meetings. Has absorbed the material. The student is active and does not sit and fiddle with anything else.	Distance mode
Prompts to interact (writing, speaking) d) The student is active when the teacher asks a question.	Remote mode Distance mode Hybrid mode
Self-regulation after repeated instruction e) I need to give the instructions again - to get the student to work. But the student works even if no teacher is present.	Remote mode
Goal orientation f) The student asks questions. This shows that he/she wants to move forward, even if it is difficult.	Remote/hybrid mode
Level 4	
Non-verbal communication a) The student is quiet but uses facial expressions. Teacher uses live video-streamed meetings to gain insight on engagement.	Hybrid mode
Balancing other demands b) The engagement is high but distributed, and the student must balance demands within and outside the school.	Hybrid mode
Evidence of learning c) During communication the student refers to insights gained from learning materials.	Distance mode
Pro-activity c) The student is active, takes the initiative, directs the group work and reports to the class. Material is included, and the camera and microphone are on.	Remote mode
Self-direction and immediacy d) The student starts working immediately. Actively working in a group even though others do not. Quick. The student is immediately interested when something new is introduced.	Hybrid mode Remote mode
Focus e) The student looks into the camera and does not do anything else.	Remote mode
Asks for help and accepts additional support f) Asked several questions to the teacher. Come to the extra room in Google Meet, where the teacher offered additional support.	Hybrid mode
Social awareness g) Student withdraws but communicates reasons. When the student participates, s/he is well-prepared and provided qualitative reflections and accepts turn-taking.	Hybrid mode
Level 5	
Nuanced engagement: desire to learn (Emo), full attention (Cog), responsiveness (Beh) and being socially secure (Soc). a) The teacher perceives the student as close and can monitor their progression. Students take responsibility for their learning.	Distance mode
Engaged b) The student is very active even when having legitimate reasons for absence.	Distance mode Remote mode
Responsibility (limited social interaction) c) Quiet but extremely engaged. Absent one lesson, but otherwise perfect attendance. If the student has been ill, s/he reads up very quickly. The student is very curious.	Hybrid mode
Asks for help and accepts additional support d) Always joins the online lessons. Students seek active contact with the teacher before and after class. Get in touch quickly when they encounter problems.	Distance mode
Responsibility (with social interaction) e) The student shows great responsibility for learning, participates in reasoning.	Distance mode

(*continued on next page*)

(*continued*)

Level 0 Educational mode	
Contributes to learning climate f) Invite other students to participate in the conversation. Creates a good learning climate.	Hybrid mode Distance mode
Self-importance g) The student may be dominant in group work. The student may take up more verbal space than his/her peers.	Remote mode
Level 6	
High demands a) S/he have such high demands on themselves that they are on sick leave.	Distance mode
Overly ambitious b) High-performing and overly ambitious; may for example write extensively more than what is required.	Distance mode Hybrid mode
Self-praise c) The student is not satisfied and does not recognise their own progression	Distance mode
Judgemental d) The student has a feeling that he/she is not good enough, that he/she must over perform.	Distance mode

Appendix D. Teacher Quotes and Coding Matrix

4.2.1 Estimating engagement is primarily an emotional, not a cognitive challenge

" [The teacher looks at the list of students.] Let's see [pause] student one [holds the whole hand to neck], hoo … [breathes out while making a soundreflecting unease] [turns from the paper, puts hand to chin while looking away]. The student [exhales heavily, then turns head back]. Yes, it's just a feeling [pauses] Okay. I would say two, yes, the second. Student 3 [pauses] Yes. [pauses] Wow, how difficult [silence]". (L1) "This student is dropping out … I feel … [sorrow]. [Mimic: teared up] It is so sad that we fail to help a student, who's not feeling well to succeed." (L1) "I feel frustrated over talking about this at an individual level, when we could address social difficulties at the group level, for students who experience these." (K2) "I don't want to say this, but I have girls who are overly ambitious." (G1).

4.3.1 Levels 0-1

"She is burnt out. Her engagement is zero, even if she used to be a six. Now, she does nothing. She doesn't even get out of bed in the morning" (I1) "It is foremost that they do not turn on the camera/ … /And then I do not get any contact./ … /And when I ask: 'What do you think?' … sometimes I do not get any reply, sometimes they say 'I didn't hear you. '/ … /How can I know that they are not asleep? "(A1).

4.3.2 Levels 2-3

" … they did not understand, and keep asking questions about what we are doing" (L1) "Not always in class" (C1).

4.3.3 Levels 4-5

"They [the students] were instantly attentive when I brought up something new" (G2) "When I asked her questions, she showed that she was well-prepared; gave extensive answers" (I1) " … socially insecure, silent, some communicated absence. I estimate her engagement to be a four with teachers, and a two with peers" (I2) "I observe that they have a rather good work pace/ … /that they are committed. Maybe they work faster than they have to do – they may also finish earlier than the others." (D1). "If they [the students] have been on sick leave, they catch up really fast./ … /And when we were doing a lab, some students bought their own equipment, even though I had material [laughs]. That's true engagement." (G1) "I told her that here are those students who are shy. So, I cannot encourage her to speak more, than others would dare to talk./ … /I feel sorry for her./ … /She only wants to show how engaged she is." (E2).

4.3.4 Level 6

"There is a critique of self, of one's own contribution. That should be included in emotional disengagement. Self-critique is a part of their anxiety. A low sense of self is a part of anxiety … " (K1) " … [the problem is that] they [the students] set too high goals, and then tries to engage to meet these. That makes them feel mentally ill." (D1) "It's a challenge to get these two ambitious, excellent girls to lower their demands [on themselves]. I wish I could. One of them has now informed the school, via her mother, that 'it is all too much'. She has crashed." (K1).

4.3.6 Engagement without inherent boundaries

"I'm the one who goes 120%, all in, and then you expect others to do the same - and I feel that I will not be able to do this all my life - that is, that you should reflect on lowering the [stress] level and there is no need to demand it of others either. There is a bad part to it.

It is good if you get it into your planning in some way: that we do [should] not require a full engagement from students, then we burn ourselves and others." (L1).

4.4.1 Complex relationships between and within dimensions and individuals

"So, this is an incredibly reflective analytical person who, I mean, s/he is not merely parroting what is written but can put everything into context. But his/her engagement is not always linked to a high level, certainly not. But [due to the high level of knowledge], I'm still safe in some way." (A2) "Yes, and then absence … Even though you have absence, there is a difference between students who find out, and check-up, do their things anyway, then there is a certain engagement even though s/he did not attend the lesson." (A1) "The student's engagement can also be seen when they are practicing. In this lesson, we had a review, [peer] interaction, review and [peer] interaction. The students participated by writing in the chat. When I said we should use breakout rooms, they reacted, and several said they did not intend to join." (L1) "The engagement of some students may impede other students from speaking." (E2) "There is a structural flaw in adopting a continuous intake [to courses]. The students who come in late experience stress; that they are behind from the beginning. They see that others have done things that they have missed. It is better to start and end at the same time and not fill up [with students]. Then you get good group dynamics and security. It becomes almost extra important for those who have experienced previous school failures. We do not have that structure now, but we may be able to get it in the future. " (K1).

Table 3
Coding Matrix: Number of utterances in relation to engagement level across modes and school year

	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
Distance (J) Year 3 upper secondary	2	2	0	4	0	7	1
Distance (K) Year 1,2 upper secondary	0	0	0	1	0	13	7
Distance (LI) Year 2 Upper secondary	0	2	3	0	0	3	1
Hybrid (D) Year 3–4 upper secondary	0	0	2	0	0	4	1
Hybrid (G) Year 9	0	0	0	0	0	2	0
Hybrid (I) Year 2 upper secondary	6	4	0	5	2	6	1
Remote (A) Year 3 upper secondary	0	4	1	0	0	1	0
Remote (B) Year 9	0	5	1	5	4	0	0
Remote (C) Year 8–9	0	2	2	2	1	2	0
Remote (E) Year 5- to upper secondary	0	0	1	0	1	6	0

References

Alrashidi, O., Phan, H. P., & Ngu, B. H. (2016). Academic engagement: An overview of its definitions, dimensions, and major conceptualisations. *International Education Studies, 9*(12), 41–52. https://doi.org/10.5539/ies.v9n12p41

Appleton, J. J., Christenson, S. L., Kim, D., & Reschly, A. L. (2006). Measuring cognitive and psychological engagement: Validation of the student engagement instrument. *Journal of School Psychology, 44*(5), 427–445. https://doi.org/10.1016/j.jsp.2006.04.002

Audas, R., & Douglas Willms, J. (2001). Engagement and dropping out of school: A life-course perspective. Applied research branch, strategic policy, human resources development Canada. https://publications.gc.ca/collections/Collection/MP32-28-01-1-10E.pdf.

Barata, G., Gama, S., Jorge, J., & Gonçalves, D. (2017). Studying student differentiation in gamified education: A long-term study. *Computers in Human Behavior, 71*, 550–585. https://doi.org/10.1016/j.chb.2016.08.049

Bawa, P. (2016). Retention in online courses: Exploring issues and solutions—a literature review. *Sage Open, 6*(1), 1–11. https://doi.org/10.1177/2158244015621777

Bergdahl, N., & Bond, M. (2021). *Negotiating K-12 (Dis-)engagement in blended learning.* Education and Information Technologies. https://doi.org/10.1007/s10639-021-10714-w

Bergdahl, N., Fors, U., Hernwall, P., & Knutsson, O. (2018). The use of learning technologies and student engagement in learning activities. *Nordic Journal of Digital Literacy, 13*(2), 113–130. https://doi.org/10.18261/ISSN.18919-943x-2018-02-04

Bergdahl, N., Nouri, J., Fors, U., & Knutsson, O. (2020). Engagement, disengagement and performance when learning with technologies in upper secondary school. *Computers and Education, 149*, 1–17. https://doi.org/10.1016/j.compedu.2019.103783

Bergdahl, N. (2022). Teachers' understanding of engagement in hybrid, remote and distance education. [Lärares förståelse av engagemang i hybrid-, fjärr, och distansundervisning]. *Pedagogisk forskning i Sverige*. . https://doi.org/10.13140/RG.2.2.23074.91848

Bhaskar, R. (2013). *A realist theory of science*. Oxford: Routledge.

Boekaerts, M. (2016). Engagement as an inherent aspect of the learning process. *Learning and Instruction, 43*, 76–83. https://doi.org/10.1016/j.learninstruc.2016.02.001

Bond, M. (2020). Facilitating student engagement through the flipped learning approach in K-12: A systematic review. *Computers & Education, 151*, Article 103819.

Bond, M., Bergdahl, N., Mendizabal-Espinosa, R., Kneale, D., Bolan, F., Hull, P., Ramadani, F., et al. (2021). *Global emergency remote education in secondary schools during COVID-19: A systematic review* (pp. 1–77). London, UK: EPPI Centre; UCL Social Research Institute; University College London.

Center for Postsecondary Research. (2018). *Indiana university school of education. NSSE - National Survey of Student Engagement.* http://nsse.indiana.edu/.

Charmaz, K., & Thornberg, R. (2021). The pursuit of quality in grounded theory. *Qualitative Research in Psychology, 18*(3), 305–327. https://doi.org/10.1080/14780887.2020.1780357

Christenson, S. L., & Reschly, A. L. (2012). Jingle, jangle, and conceptual haziness: Evolution and future directions of the engagement construct. In *Handbook of research on student engagement* (pp. 3–19). New York: Springer. https://doi.org/10.1007/978-1-4614-2018-7_1.

Christenson, S. L., & Thurlow, M. L. (2016). *Https://Doi.Org/10.1111/j.0963-7214.2004.01301010.X. School dropouts: Prevention considerations, interventions, and challenges, 13* pp. 36–39). https://doi.org/10.1111/J.0963-7214.2004.01301010.X, 1.

Cleary, T. J., & Zimmerman, B. J. (2012). A cyclical self-regulatory account of student engagement: Theoretical foundations and applications. *Handbook of Research on Student Engagement*, 237–257. https://doi.org/10.1007/978-1-4614-2018-7_11

Connell, J. P., & Wellborn, J. G. (1991). Competence, autonomy, and relatedness: A motivational analysis of self-system processes. *Self-Processes and Development. The Minnesota Symposia on Child Psychology, 23*, 43–77, 1954.
Creswell, J., & Clark, V. (2011). *Designing and conducting mixed methods research* (2nd ed.). SAGE Publications.
Curtis, H., & Werth, L. (2015). Fostering student success and engagement in a K-12 online school. *Journal of Online Learning Research, 1*(2), 163–190.
Denscombe, M. (2014). *The good research guide: For small-scale social research projects*. UK: McGraw-Hill Education.
Finn, J. D. (1989). Withdrawing from school. *Review of Educational Research, 59*(2), 117–142. https://doi.org/10.3102/00346543059002117
Finn, J. D., & Cox, D. (1992). Participation and withdrawal among fourth-grade pupils. *American Educational Research Journal, 29*(1), 141–162. https://doi.org/10.3102/00028312029001141
Fox, J. (2018). An unlikeable truth: Social media like buttons are designed to be addictive. They're impacting our ability to think rationally. *Index on Censorship, 47*(3), 11–13. https://doi.org/10.1177/0306422018800245
Fredricks, J. A., Blumenfeld, P. C., & Paris, A. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research Spring, 74*(1), 59–109. https://doi.org/10.3102/00346543074001059
Fredricks, J. A., Reschly, A. L., & Christenson, S. L. (2019). In A. L. Reschly, & S. L. Christenson (Eds.), *Handbook of student engagement interventions: Working with disengaged students (Jennifer A; Fredricks*. Elsevier.
Gareau, A., Chamandy, M., Kljajic, K., & Gaudreau, P. (2019). The detrimental effect of academic procrastination on subsequent grades: The mediating role of coping over and above past achievement and working memory capacity. *Anxiety, Stress & Coping, 32*(2), 141–154. https://doi.org/10.1080/10615806.2018.1543763
Gebhardt, E., Fraillon, J., Schulz, W., Friedman, T., & Ainley, J. (2014). Preparing for life in a digital age. In *The IEA international Computer and information literacy study international report*. https://doi.org/10.1007/978-3-319-14222-7
Gilbert, L. S., Jackson, K., & di Gregorio, S. (2014). Tools for analysing qualitative data: The history and relevance of qualitative data analysis software. In *Handbook of research on educational communications and technology* (pp. 221–236). New York: Springer. https://doi.org/10.1007/978-1-4614-3185-5_18.
Gilgun, J. F. (2015). Http://Dx.Doi.Org.Ezp.Sub.Su.Se/10.1177/1473325015606513. *Beyond description to interpretation and theory in qualitative social work research, 14* pp. 741–752). https://doi.org/10.1177/1473325015606513, 6.
Gilgun, J. F. (2019). Deductive qualitative analysis and grounded theory: Sensitising concepts and hypothesis-testing. In *, Vol. 14. The SAGE Handbook of current developments in Grounded theory*. London, England: SAGE Publications UK. https://doi.org/10.4135/9781526485656. Issue 6.
Giovannella, C., Passarelli, M., & Persico, D. (2020). The effects of the covid-19 pandemic on Italian learning ecosystems: The school teachers' perspective at the steady-state. *Interaction Design and Architecture(S), 45*, 264–286.
Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research*. Aldine Publishing.
Grissom, S., McCauley, R., & Murphy, L. (2017). How student centered is the computer science classroom? A survey of college faculty. *ACM Transactions on Computing Education, 18*(1), 1–27. https://doi.org/10.1145/3143200
Grønborg, L. (2013). One of the boys: Constructions of disengagement and criteria for being a successful student. *International Journal of Qualitative Studies in Education, 26*(9), 1192–1209. https://doi.org/10.1080/09518398.2013.816889\
Grönlund, A. (2020). *Skolans fjärrundervisning under Coronapandemin 2020 [remote education during the Corona pandemic 2020]*. Handelshögskolan: Örebro universitet.
Guetterman, T. C., Babchuk, W. A., Smith, M. C. H., Stevens, J., Howell Smith, M. C., & Stevens, J. (2019). Contemporary approaches to mixed methods–grounded theory research: A field-based analysis. *Journal of Mixed Methods Research, 13*(2), 179–195. https://doi.org/10.1177/1558689817710877
Guetterman, T. C., Fetters, M. D., & Creswell, J. W. (2015). Integrating quantitative and qualitative results in health science mixed methods research through joint displays. *The Annals of Family Medicine, 13*(6), 554–561. https://doi.org/10.1370/afm.1865
Halverson, L. R. (2016). *Conceptualising blended learning engagement. Doctoral Dissertation*. USA: Brigham Young University.
Halverson, L. R., & Graham, C. R. (2019). Learner engagement in blended learning environments: A conceptual framework. *Online Learning, 23*(2). https://doi.org/10.24059/olj.v23i2.1481
Harshbarger, T. B., & Kesehatan, K. (2019). *Student-teacher relationships: Linking relations constructs of closeness, conflict and dependency to student achievement*. USA: Ball State University. Doctoral Dissertation.
Hattie, J. (2009). Visible learning. In *Visible learning: A Synthesis of over 800 Meta-Analyses relating to achievement*. https://doi.org/10.4324/9780203887332
Heemskerk, C., Hubertina, C., Heemskerk, H. M., & Malmberg, L.-E. (2020). Students' observed engagement in lessons, instructional activities, and learning experiences. *Frontline Learning Research, 8*(6), 38–58. https://doi.org/10.14786/flr.v8i6.613
Henrie, C. R. (2016). *Measuring Student Engagement in Technology-Mediated Learning Environments (Doctoral Dissertation)*. Brigham Young University. https://scholarsarchive.byu.edu/etd. (Accessed 15 February 2019). ProQuest Dissertations and Theses.
Henrie, C. R., Halverson, L. R., & Graham, C. R. (2015). Measuring student engagement in technology-mediated learning: A review. *Computers & Education, 90*, 36–53. https://doi.org/10.1016/j.compedu.2015.09.005
Hietajärvi, L., Salmela-Aro, K., Tuominen, H., Hakkarainen, K., & Lonka, K. (2019). Beyond screen time: Multidimensionality of socio-digital participation and relations to academic well-being in three educational phases. *Computers in Human Behavior, 93*, 13–24. https://doi.org/10.1016/J.CHB.2018.11.049
International Association for K-12 Online Learning L. (2019). *National standards for quality online teaching*. https://www.nsqol.org/.
Jang, H., Kim, E. J., & Reeve, J. (2016). Why students become more engaged or more disengaged during the semester: A self-determination theory dual-process model. *Learning and Instruction, 43*, 27–38. https://doi.org/10.1016/j.learninstruc.2016.01.002
Jang, H., Reeve, J., & Deci, E. L. (2010). Engaging students in learning activities: It is not autonomy support or structure but autonomy support and structure. *Journal of Educational Psychology, 102*(3), 588–600. https://doi.org/10.1037/a0019682
Kafle, N. P. (2013). Hermeneutic phenomenological research method simplified. *Bodhi: An Interdisciplinary Journal, 5*(1), 181–200. https://doi.org/10.3126/bodhi.v5i1.8053
Kim, D. Y., Cardenas, I. S., & Kim, J. H. (2017). Engage/Disengage: Control triggers for immersive telepresence robots. HAI 2017. In *proceedings of the 5th international conference on human-agent interaction* (pp. 495–499). https://doi.org/10.1145/3125739.3132603
Lave, J., & Wenger, E. (1991). Situated learning: Legitimate peripheral participation. *Learning in Doing*. . https://doi.org/10.2307/2804509
Lawson, H. A., & Lawson, M. A. (2020). Student engagement and disengagement as a collective action problem. *Education Sciences, 10*(8), 1–20. https://doi.org/10.3390/educsci10080212
Lindfors, M., & Pettersson, F. (2021). K–12 students' experiences of the synchronous remote teaching and learning environment. *Journal of Online Learning Research, 7*(3), 249–268.
Ma, J., Cheng, J., & Han, X. (2018). Initial development process of a student engagement scale in blended learning environment. In *Proceedings - 6th international conference of educational Innovation through technology* (pp. 234–237). EITT. https://doi.org/10.1109/EITT.2017.63. *2017, 2018-March*.
Martin, F., Wang, C., Sadaf, A., Sun, T., & Westine, C. D. (2020). A systematic review of research on online teaching and learning from 2009 to 2018. *Computers and Education, 159*(1), Article 104009. https://doi.org/10.1016/j.compedu.2020.104009
Montgomery, A. P., Mousavi, A., Carbonaro, M., Hayward, D. V., & Dunn, W. (2019). Using learning analytics to explore self-regulated learning in flipped blended learning music teacher education. *British Journal of Educational Technology, 50*(1), 114–127. https://doi.org/10.1111/bjet.12590
Mosher, R. B. (1985). *Assessing student engagement in secondary schools: Alternative Conceptions, strategies of assessing, and Instruments*. University of Wisconsin, Research and Development Center (ERIC Document Reproduction Service No. ED 272812).
Nørgård, R. T. (2021). Theorising hybrid lifelong learning. *British Journal of Educational Technology, 52*(4), 1709–1723. https://doi.org/10.1111/BJET.13121
Payne, S. (2016). Grounded theory. In E. Lyons, & A. Coyle (Eds.), *Analysing qualitative data in Psychology* (2nd ed., pp. 119–146). Los Angeles, CA: SAGE Publications.
Pekrun, R. (2011). Emotions as drivers of learning and cognitive development. In *New perspectives on affect and learning technologies* (Vol. 3, pp. 22–39). New York: Springer. https://doi.org/10.1007/978-1-4419-9625-1_3
Pekrun, R., & Linnenbrink-Garcia, L. (2012). Academic emotions and student engagement. In S. Christenson, A. Reschly, & C. Wylie (Eds.), *Handbook of Research on student engagement* (pp. 259–282). New York: Springer. https://doi.org/10.1007/978-1-4614-2018-7_12.

Pöysä, S., Vasalampi, K., Muotka, J., Lerkkanen, M. K., Poikkeus, A. M., & Nurmi, J. E. (2018). Variation in situation-specific engagement among lower secondary school students. *Learning and Instruction, 53*, 64–73. https://doi.org/10.1016/j.learninstruc.2017.07.007

Raes, A., Detienne, L., Windey, I., & Depaepe, F. (2020). A systematic literature review on synchronous hybrid learning: Gaps identified. In *Learning environments research* (Vol. 23, pp. 269–290). Springer. https://doi.org/10.1007/s10984-019-09303-z, 3.

Reeve, J. (2012). A self-determination theory perspective on student engagement. In S. Christenson, A. Reschly, & C. Wylie (Eds.), *Handbook of Research on student engagement* (pp. 149–172). New York: Springer. https://doi.org/10.1007/978-1-4614-2018-7_7.

Reeve, J. (2013). How students create motivationally supportive learning environments for themselves: The concept of agentic engagement. *Journal of Educational Psychology, 105*(3), 579–595. https://doi.org/10.1037/a0032690. *Article in*.

Reeve, J., Cheon, S. H., & Jang, H.-R. (2019). A teacher-focused intervention to enhance students' classroom engagement. *Handbook of Student Engagement Interventions*, 87–102. https://doi.org/10.1016/B978-0-12-813413-9.00007-3

Salmela-Aro, K., & Read, S. (2017). Study engagement and burnout profiles among Finnish higher education students. *Burnout Research, 7*, 21–28. https://doi.org/10.1016/J.BURN.2017.11.001

Salmela-Aro, K., Upadyaya, K., Hakkarainen, K., Lonka, K., & Alho, K. (2017). The dark side of internet use: Two longitudinal studies of excessive internet use, depressive symptoms, school burnout and engagement among Finnish early and late adolescents. *Journal of Youth and Adolescence, 46*(2), 343–357. https://doi.org/10.1007/s10964-016-0494-2

Scanlon, C. L., Del Toro, J., & Wang, M. T. (2020). Socially anxious science achievers: The roles of peer social support and social engagement in the relation between adolescents' social anxiety and science achievement. *Journal of Youth and Adolescence, 49*(5), 1005–1016. https://doi.org/10.1007/s10964-020-01224-y

Schaufeli, W. B., Salanova, M., González-romá, V., & Bakker, A. B. (2002). The measurement of engagement and burnout: A two sample confirmatory factor analytic approach. *Journal of Happiness Studies, 3*(1), 71–92. https://doi.org/10.1023/A:1015630930326

Skinner, E. A., & Belmont, M. J. (1993). Motivation in the classroom: Reciprocal effects of teacher behavior and student engagement across the school year. *Journal of Educational Psychology, 85*(4), 571–581. https://doi.org/10.1037/0022-0663.85.4.571

Skinner, E, A, & Belmont, M, J (1993). Motivation in the Classroom: Reciprocal Effects of Teacher Behavior and Student Engagement Across the School Year. *Journal of Educational Psychology, 85*(4), 571–581. https://doi.org/10.1037/0022-0663.85.4.571

Skinner, E., Furrer, C., Marchand, G., & Kindermann, T. (2008). *Engagement and disaffection in the classroom: Part of a larger motivational dynamic?* (Vol. 100, pp. 765–781). https://doi.org/10.1037/a0012840, 4.

Symonds, J.E, Kaplan, A., Upadhyaya, K., Salmela-Aro, K., Torsney, B., Skinner, E. & Eccles, J. S. (pre-print, 2021) momentary engagement as a complex dynamic system. PsyArXiv. DOI: 10.31234/osf.io/fuy7p.

The School Act [Skollagen]. (2010) (p. 800). Pub. L. No. SFS nr, 2010.

The Swedish National Agency for Education [Skolverket]. (2020a). *More to be offered remote education [Fler elever ska kunna erbjudas fjärrundervisning.* Pressmeddelande.

The Swedish National Agency for Education [Skolverket]. (2020b). *Nya regler för fjärr- och distansundervisning*.

The Swedish National Agency for Education [Skolverket]. (2020c). *Remote education and certain entrepreneurial issues [Fjärrundervisning, distansundervisning och vissa frågor om entreprenad]*. Referral from the Legal Council of State [Lagrådsremiss].

Wang, M. T., & Fredricks, J. A. (2014). The reciprocal links between school engagement, youth problem behaviors, and school dropout during adolescence. *Child Development, 85*(2), 722–737. https://doi.org/10.1111/cdev.12138

Wang, M.-T. T., Fredricks, J., Ye, F., Hofkens, T., & Linn, J. S. (2017). Conceptualisation and assessment of adolescents' engagement and disengagement in school. *European Journal of Psychological Assessment, 35*(4), 592–606. https://doi.org/10.1027/1015-5759/a000431

Wang, M.-T., & Hofkens, T. L. (2019). Beyond classroom Academics: A school-wide and multi-contextual perspective on student engagement in school. *Adolescent Research Review, 5*, 419–433. https://doi.org/10.1007/s40894-019-00115-z

Wigfield, A., Klauda, S. L., & Cambria, J. (2018). Influences on the development of academic self-regulatory processes. *Handbook of self-regulation of learning and performance*, 33–48. https://doi.org/10.4324/9780203839010.ch3

Yazzie-Mintz, E. (2007). *Voices of students on engagement: A report on the 2006 high school Survey of student engagement. Center for evaluation and education Policy*. Indiana University.

Zhang, Z., Li, Z., Liu, H., Cao, T., & Liu, S. (2020). Data-driven online learning engagement detection via facial expression and mouse behavior recognition technology. *Journal of Educational Computing Research, 58*(1), 63–86. https://doi.org/10.1177/0735633119825575