Chapter 7

Cracking the Engagement Enigma: Decoding the Multifaceted Sociocultural Influences on Student Engagement in Digital Learning

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Introduction

Engaging students in learning, and within their learning community, is recognised as a vital aspect of education (Bond et al., 2020; Martin & Bolliger, 2018). Yet, this complex construct remains somewhat of an enigma for teachers, learning designers, educational institutions, and researchers, owing in part to the multiple ways in which it is theorised, interpreted, and understood (Eccles, 2016; Zepke, 2018). This is made even more complex by the increasing modes of educational distribution, where online (digital) and on-site (physical) modes blur the boundaries and situatedness of the student experience across multiple places and spaces in which students engage with learning (Bergdahl, 2022b).

Engagement is a ubiquitous word and is used to refer to a range of activities and behaviours, prompting some to refer to it as a 'black box' (Bryson & Hardy, 2012) or as a "catch-all term" (Krause, 2005, p. 3). While student engagement can be approached without defining any particular level of abstraction (Appleton et al. 2008; Fredricks et al., 2004), there are nuanced differences in conceptualisations, depending on context (school engagement or academic engagement; Wong & Liem, 2022), as well as the discipline of the researcher, such as educational psychologists and educational technologists. For example, the former may rely more on student and educator self-reports, observations, and interview data (Henrie et al., 2015; 2018) while the latter more often collects system log data (Brown et al., 2024) or use computational methods (Bergdahl, et al., forthcoming; Bond et al., 2023).

In common, is that the interpretations and definitions of student engagement seem to include at least one of several key points: the time and energy directed to a task; observable behaviours linked to learning; the complexity of factors related to engagement; and that engagement may fuel further engagement (Bond et al., 2020; Bond et al., 2023; Krause, 2005). Engagement has also been confused with other terminology and behaviours (Lim, 2004; Reschly & Christenson, 2012). This is another reason for theoretical confusion in research, where definitions and operationalisation of student engagement differ widely, or are not explained at all (Bond, 2020b; Bond et al., 2023; Henrie et al., 2015). Theories of motivation affirm the significance of engagement as "energy in action", aiding in differentiating components within the meta-construct of engagement and suggesting a common structure for theories of engagement (Russell et al., 2005). We, therefore, define engagement in the following way:

> *Student engagement is a multidimensional construct, and it is the behavioural, cognitive, emotional, and social energy and effort that students direct towards learning.*

Thus, engagement does not occur in a vacuum, but is shaped by various structural, as well as external and internal influences, such as the complex interplay of social relationships, learning activities, and the learning environment (Bergdahl & Bond, 2021; Kahu, 2013; Quin, 2017; Redmond et al., 2018). In addition, the broader socio-political context also impacts student engagement and needs to be considered for a balanced understanding (Appleton et al., 2008), including the influence of the 'digital space' on all aspects of modern teaching and learning (Bond & Bergdahl, 2022). The digital space includes the multifaceted factors that impact student engagement at various levels and across various modes (e.g., blended, hybrid, online), and can be referred to as 'digital learning'. A deep appreciation and understanding of the digital space is critical, if we are to respond to and support learning in ways that are

meaningful and relevant (Bergdahl & Hietajärvi, 2022; Bond, 2020a). With this in mind, this chapter intends to reveal and explore how the Student Engagement in Digital Learning (SEDL) framework (see Figure 1) can act as a 'code breaker' to support a richer understanding of the interconnected, multidirectional milieus in which factors impacting student engagement are situated, and to highlight how the framework has been (or has not been) applied in research. We then expand on this work by drawing attention to the chronosystem and providing suggestions and future directions for policy, practice, and research.

The Student Engagement in Digital Learning Framework

The Student Engagement in Digital Learning (SEDL) framework was inspired by and based primarily on Bronfenbrenner and colleagues' model of human and child development (e.g., Bronfenbrenner, 1979), as well as the work of Kahu (2013; Kahu & Nelson, 2018), out of a recognition that digitalisation and the growing need for blended modes of learning requires a serious shift in thinking when it comes to engagement (Stokols, 2018). Ecological systems theory affords a deeper understanding of a range of complex societal issues, such as climate change, escalation of youth crime or drug addiction (e.g., Ma et al., 2022). However, this theory has also been used in educational contexts, such as by Wang et al. (2019) and Skinner et al. (2022) in the development of their respective student engagement models.

More recently, reference to ecological systems theory has been embraced to understand the increasing integration of technology or 'digitalisation' within education contexts (Crompton, 2017; Crompton et al., 2023; Hennessy et al., 2022). For example, Navarro and Tudge (2022), proposed a 'Neo-ecological' model, recognising the impact of digitalisation by acknowledging that individuals in digital learning environments can 'be' in several online and physical spaces simultaneously, while also suggesting that the meso-level

could include the interrelation between in person and virtual microsystems, or between two or more virtual microsystems. Similar to this, although in contrast to Bronfenbrenner's model, the SEDL specifically addresses how macro, meso, exo and micro system levels are influenced by digitalisation, and influence student engagement, rather than separating the physical from the virtual.

The SEDL framework was developed through an iterative process that involved a thorough examination of literature on student engagement, encompassing both theoretical perspectives and primary/secondary empirical research (Bond & Bedenlier, 2019; Bond, 2020b; Bond, 2020c; Bond et al., 2020; Bond et al., 2021). Empirical studies were also conducted to further contribute to its development (Bond, 2019; Bond & Bergdahl, 2021), including furthering the understanding of manifestations of engagement and disengagement in digital learning environments (Bergdahl et al., 2018a; 2019a; Bergdahl & Bond, 2021) and the social dimensions of student engagement and disengagement in online learning (Bergdahl, 2022b; Bond & Bergdahl, 2022, Bergdahl & Hietajärvi, 2022). The framework portrays the way that engagement can be affected by a range of internal and external factors. As students become more engaged, the more likely it is that engagement will lead to a range of short- and long-term outcomes, which will then further affect engagement, and subsequently the learning environment, in a flowing loop. This flow of influence, engagement and outcomes are also identified in the Development-in-Social Context Model of Student Engagement (DISC) by Wang et al. (2019) (see also Wang et al., this volume) and the Complex Social Ecology of Academic Functioning and Development by Skinner et al. (2022).

Within the Technology-Enhanced (or digitalised) learning environment, the student is positioned at the centre of a network of interconnected milieus and is influenced by internal factors (see Figure. 2), such as their motivation, acceptance of technology, prior ICT

experiences, and their level of digital knowledge and skills. Beyond these immediate internal influences, are microsystem factors that include the close relationships they have with others, such as their peers, and the interactions they have within their learning community. The next level is referred to as the mesosystem, which reflects the interrelation between systems, including between microsystems, as well as the socio-economic background that the student comes from (Eng et al., 2014). The exosystem includes broader social structures that impact on student learning, such as institutional policies, the media, social services, and employment, and shaping the environment where all these interactions are occurring are those in the macrosystem, which includes national/regional policies, the economy, culture, and legal systems.

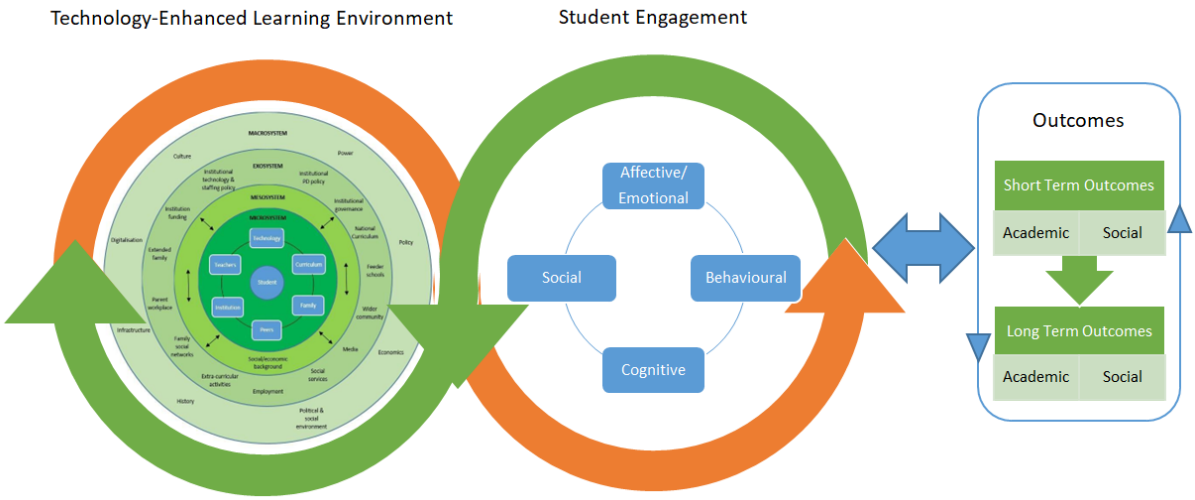

Figure 1.

Student Engagement in Digital Learning Framework (SEDL).

Adapted from Bond, 2020a and Bond & Bedenlier, 2019, p. 8)

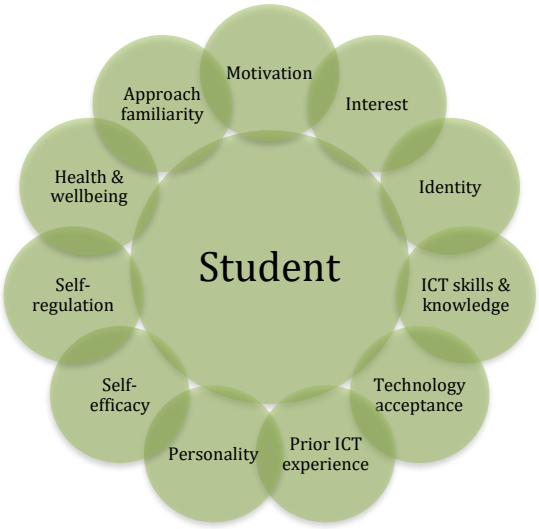

Figure 2. *Student / Individual psychosocial influences on engagement*

Furthermore, it is important not to overlook the sociocultural and temporal dimensions, the narratives, behaviours, and experiences that occur through and across time, and that students carry with them into their educational experiences. These dimensions and factors have a strong influence on their engagement (Wang et al., 2019). As students participate and demonstrate engagement across online and on-site spaces (Bergdahl, 2022a; Bergdahl & Hietajärvi, 2022; Bond & Bergdahl, 2022; Brown et al., 2022; Redmond et al., 2023), their prior experiences not only shape their current engagement levels, but also impact their self-perception, self-efficacy, goals, and perceived gains. This dynamic is especially critical during adolescence, as these evolving experiences of engagement contribute to the ongoing process of identity formation and self-efficacy. We will now explore and decode each level of the SEDL through distinct, yet interconnected lenses, to examine and better appreciate how students engage with and within their learning environments, as well as the factors that influence their engagement.

Macrosystem-Level Influences on Student Engagement

The macrosystem encompasses the broader sociocultural contexts influencing student engagement (see Figure 3). These contexts include and are shaped by national and international educational policies, societal norms, and cultural values. It is crucial to understand how these overarching elements influence students' attitudes towards learning and their engagement patterns, as these macrosystemic factors influence all levels of the ecosystem (Navarro & Tudge, 2022). The macro level also includes infrastructure and digitalisation, which can have a large impact on students' ability to engage and learn successfully (Mac Domhnaill et al., 2021; O'Neill, 2015), or for schools to implement educational policies set out by governments (Hennessy et al., 2022).

For example, a lack of access to the National Broadband Network in rural Australia, contributed to reductions in parent engagement with students' learning and within the school community, as well as having a direct impact on students' ability to engage with learning (Bond, 2019), as did load shedding in Zambia, where a reduction in power support leads to significant power outages (Bwalya Umar et al., 2022). This issue also extends to the presence of digital infrastructure in universities and professional development opportunities for staff providing teacher education (Rana & Rana, 2020). Furthermore, a lack of infrastructure, particularly in developing countries, may also lead to further inequality in terms of accessibility to the technology required for engagement, including the use of newer technologies, such as generative Artificial Intelligence (AI) (Mannurum et al., 2023).

At the macrosystem level, sociocultural factors such as societal values and beliefs about education can significantly influence student engagement. For instance, in cultures where education is highly valued, students might exhibit higher cognitive and emotional engagement. Conversely, systemic societal issues such as inequality or marginalisation can contribute to disengagement, as learners from disadvantaged backgrounds might struggle to access or relate to educational content and practices.

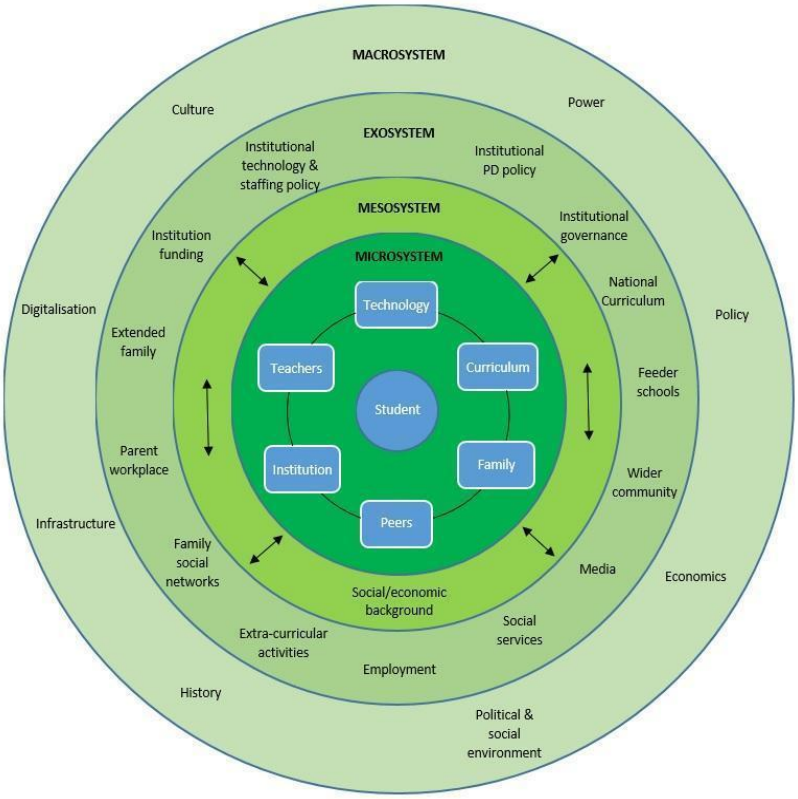

Figure 3. *External influences on student engagement*

In a response to a call for evidence on generative AI uses in education, the Department for Education in England announced the acceleration of gigabit capable broadband rollout by 2025, including investing £200 million in schools within 55 identified disadvantaged areas (Department for Education, 2023). However, this level of infrastructure investment is not possible for many countries, although recommendations are being made (e.g., OECD, 2023). A review of 24 national AI strategies published between 2016 and 2020 found that one-third addressed AI integration into teaching and learning (Schiff, 2022), although a subsequent investigation of 11 national policies in Europe found that only five nations were investing in AI Education, particularly through AI literacy initiatives (Foffano et al., 2023). In parallel, the EU is passing its first legislation on AI, clarifying acceptable (e.g., chatbots in class) and non-acceptable uses (e.g., collecting student biometrics) (European Commission, 2024).

Turning to mobile learning, research has indicated that they may facilitate student engagement and function as assistive devices in learning (Song et al., 2023). However, concerns around adverse effects such as cyberbullying, internet addiction, and digital distraction have led to a number of countries banning the use of mobile phones in schools (Selwyn & Aagaard, 2021); estimated by UNESCO to be one in four (UNESCO, 2023). Countries include France (BBC News, 2018), Sweden (The Nordic Times, 2023), Australia (Roberts et al., 2023), and the Netherlands from 2024 (The Guardian, 2023), despite evidence from Swedish secondary schools that the ban would not improve student achievement (Kessel et al., 2020). For families and schools in lower-socio economic areas and developing countries, however, mobile phones might be the only form of technology that they own or have easy access to (Faloye & Ajayi, 2022). Top level governmental policy decisions can therefore have an enormous effect on the extent to which students are able to engage with learning and within the learning environment.

Exosystem-Level Influences on Student Engagement

Situated within the exosystem are environmental factors that affect a student's engagement indirectly, including the influence of parental employment patterns, community structures, and media. However, this level also includes institutional policies, culture, and funding. For example, schools and universities that foster a culture focused on student achievement, set high standards and expectations for both learners and educators, and invest in support mechanisms and infrastructure such as stable internet access and technology (e.g., desktop computers, Wi-Fi extenders), increase the likelihood of enhanced student engagement (Almarghani & Mijatovic, 2017; Peters & Romero, 2019), with the use of technologies in the classroom considered part of the microsystem level (see below).

The policies that a school has around professional development can also have an indirect impact on the efficacy of educational interventions (Fletcher-Wood & Zuccollo,

2020; Lynch et al., 2019), including digital learning (Bond, 2019; Gerick et al., 2017). Hennessy et al. (2022), for example, undertook a systematic review of 170 studies about technology use in teacher professional development from 40 low- and middle-income countries and found that infrastructure was particularly problematic at both the macro and micro levels, with access to equipment challenging, as well as a low uptake of using technology within teaching in some cases (Dlamini & Mbatha, 2018). Policies on the use of technology within schools can also be prohibitive. Collaborative technologies such as Google Docs and other collaborative brainstorming tools have been found to facilitate increased engagement, through quality peer interactions and critical thinking (Bond, 2020b). However, some state governments have strict data protection laws that regulate the use of certain software, including cloud-based services, such as the use of Microsoft 365 products in the German state of Hessen (Der Hessische Beauftragte für Datenschutz und Informationsfreiheit, 2023). Bring Your Own Device initiatives within schools can also present challenges (Adhikari et al., 2016), such as ongoing digital divide concerns (Pelletier et al., 2023), concerns about allowing technology in schools (Mawere et al., 2022), and difficulties arising from students using devices that are incompatible with the school's technology, potentially affecting their ability to engage with learning (Bond, 2019), alongside directly impacting teachers' ability to implement digital learning in novel ways.

In countries with strict attendance or compulsory education laws (e.g., Sweden), (the macro-system) the adoption of technologies, such as telepresence robots, is generally limited to specific cases, decided by schools (the exo-system) rather than becoming a widely accepted solution for fulfilling attendance requirements. A telepresence robot is placed in the classroom, to embody an absent student. The students, attending from elsewhere (typically hospital, institution, or home) connects to the classroom through the robot, which they control. In class, the robot-peer interaction imitates student-student and teacher-student

interaction and has been seen to support social inclusion and enable continuous education for students who otherwise needed to battle both their illness and subsequently a re-entry into another class, establishing connections with new peers, to re-take the lost time of schooling (e.g., Weibel et al., 2023). While such uses of technology may open up more flexible possibilities for students' academic engagement, their integration is limited primarily due to a legislative emphasise on *compulsory physical attendance*, where physical presence is viewed as superior to online participation. On the other hand, countries with a legislative focus on *compulsory schooling* (e.g., Finland; The Parliament of Finland, 1998), can be more flexible in terms of the physical location of the learner, thereby enabling broader scale digital solutions to facilitate students' inclusion and academic engagement. Therefore, to fully meet attendance obligations, more is needed than just technological innovation; a change in policy that recognizes remote participation as a valid form of attendance is also required. Such changes would necessitate extensive discussions within the education sector, including assessments of educational, social, and legal aspects. Integrating multiple modes of education as standard would enable a more inclusive education; one that caters to the different needs to engage in learning and could also be a guarantor for sustained education during uncertain societal times (Moore & Barbour, 2023). Currently, education regulation may or may not allow for remote, hybrid or distance schooling. Differences in restrictions on how digital technologies may be used, to mediate learning or as tools within a learning setting, directly affect learner and teacher interaction, social inclusion, and engagement in learning.

Mesosystem-Level Influences on Student Engagement

The mesosystem refers to the interactions that occur between or across the different contexts in which the student operates. Examples of the interrelatedness of these factors may include the interplay between family dynamics and the school environment, or the interaction of socioeconomic status of a student's family (microsystem, see Figure 4) and the

school/immediate community (microsystem, see Figure 5). These factors could in turn impact on a family/student's capacity to afford devices (Adhikari et al., 2016) as well as their internet access and the quality of this connection (Bond, 2019). Consequently, dynamic factors at the meso level have the potential to not only shape student equity of accessibility (see Figure. 4), but also influence attitudes towards technology, and their ability and willingness to engage in education and learning.

A case in point occurred during the COVID-19 pandemic, where most schools closed, and learning shifted to emergency remote teaching (ERT); a ragged mixture of distance, online, blended, and hybrid learning, depending upon the socioeconomic context that students and families were located (Bergdahl & Nouri, 2020; Bond, 2020a; Bond et al., 2021). At this time, many teachers across all sectors, including higher education (Brown et al., 2023a), reported being left to their own devices to design for learning in this new and unfamiliar online learning environment (Bergdahl & Nouri, 2020). This included grappling with ways to support interaction with students and their families, especially in cases where families only had one device between family members (Bond & Bergdahl, 2021). At times of crisis, but also as part of daily life in these digitally pervasive times, equitable access to affordable hardware and software options has a bi-directional impact on student engagement (Adams Becker et al., 2018).

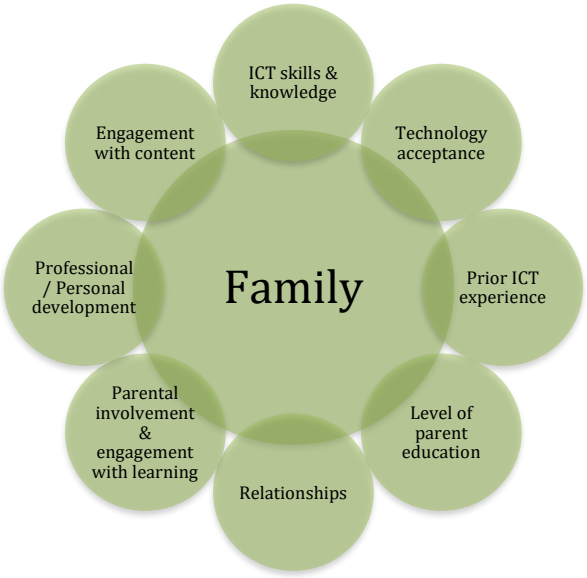

Figure 4. *Family influences on student engagement*

Microsystem-level Influences on Student Engagement

The microsystem is closest to the student and most pervasive in terms of influencing behaviours, values, attitudes and actions. This system includes the immediate environments a student moves and loves within, such as the educational institution the student attends, their classroom, their peer groups and their family (including parental prior experiences with the education system and technology) (Bond & Bedenlier, 2019; O'Neill, 2015). The quality of interactions in these settings directly impacts student engagement, wellbeing, success, and sense of connectedness (Aldridge & McChesney, 2018).

A recent meta-analysis of factors influencing student engagement in higher education (Li & Xue, 2023), found that factors such as positive teacher behaviour, a supportive learning environment and provision of quality learning resources, the teacher-student relationship, and a range of students' individual characteristics and approaches to learning, all contribute to promoting higher levels of engagement, which can shift attitudes towards online teaching and learning (Moore & Barbour, 2023) (see Figure. 5). Alternatively, it was found that a lack

of environmental support was a hindering factor, alongside negative student, and teacher behaviour. These insights reinforce that factors that are positioned within the microsystem, such as teachers' digital skills, self-efficacy, and confidence, not only impact on their pedagogy and implementation within the classroom (Stringer et al., 2022), but directly impact on student engagement.

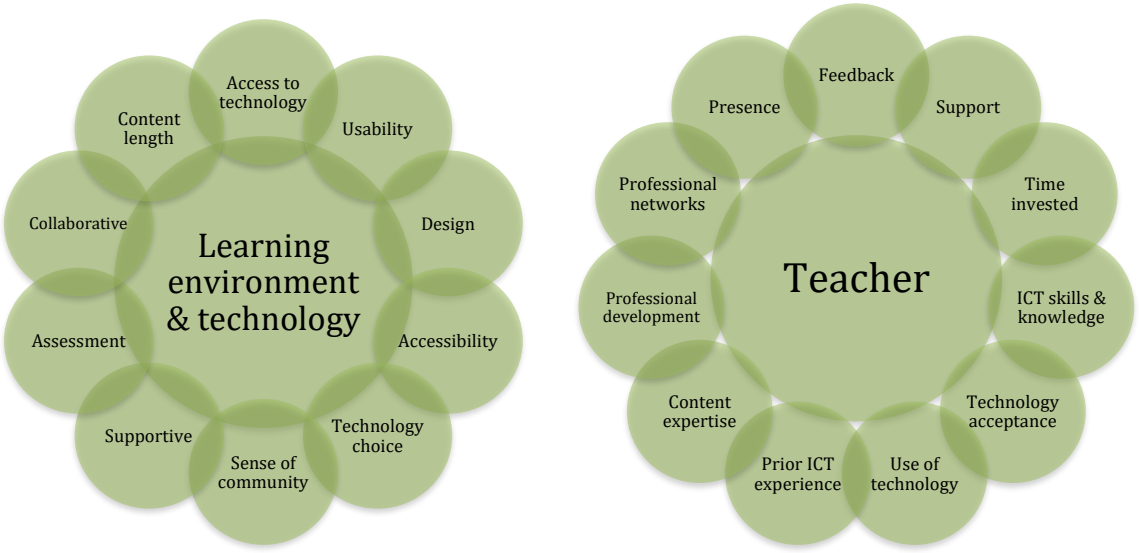

Figure 5. *Learning environment and teacher influences on student engagement*

Using AI in education can provide timely and individualised support, making the learning environment more interactive and responsive (Bond et al., 2024). Generative AI, used to augment intelligent tutoring systems, might help the collection and use of data to detect student disengagement (UNESCO, 2023). There is also potential for GenAI to help students in disadvantaged countries through personalised learning, and to improve their writing and academic performance. However, with these tools, there are still issues related privacy, equity and access (Bond et al., 2024; Mannuru et al., 2023) in addition to questions of teacher agency and digital skills (Bond et al., 2024) learning design, assessment and AI literacy that need to be addressed (Bergdahl & Sjöberg, 2023).

Interviewing students and academics in Brazil, India, Japan, the United Kingdom, and the USA, one study concluded that ChatGPT is expected to become a standard assignment support method (Ibrahim et al., 2023). However, AI technology is more than ChatGPT or large language models[1]. We can expect AI systems to be used more frequently in the future to help write articles or essays, outline papers, create original artwork, or act as collaborators (Gibson et al., 2023), as well as to potentially assist teachers with marking and lesson planning.

Dimensions and Indicators of Student Engagement

Student engagement manifests itself in a variety of different ways, as a result of any combination of influential factors from across the macro, exo, meso and micro levels discussed above. However, it is widely believed that there are three dimensions of student engagement – behavioural (Bergdahl, 2022a; Chung et al., 2022; Summers et al., 2023; Walsh et al., 2021; Yoon et al., 2021), affective/emotional (Emerson et al, 202; Hisey et al., 2022; Sherifi et al, 2023), and cognitive (Chen et al., 2018; Fredricks et al., 2004; Lustigova & Brom, 2014; Martin & Borup, 2022). More recently, recognition of social engagement as a fourth dimension has become increasingly supported, due to it being understood as a pre-cursor or necessary enabler of other forms of engagement (Bond & Bergdahl, 2022; Brown et al., 2023c; Lu & Churchill, 2014; Redmond et al., 2018; Wang et al., 2017). Within each dimension are many indicators of engagement (see Table 1), or disengagement (Bergdahl, 2022a; Brown et al., 2023b; Mazman Akar, 2024; Papamitsiou et al., 2020; Wang, 2023), with each of these dimensions now further explained (see Table 2).

[1] See for example https://tinyurl.com/aiedk12, https://cognimates.me/home/, https://machinelearningforkids.co.uk/, https://ai4k12.org/ , https://raise.mit.edu/, https://craft.stanford.edu /, https://www.teachai.org/

While the phenomenon of engagement does not change in online settings, the teachers' perception of engagement when students learn online, including the tools used to mediate engagement, and the tools used to gather insights on engagement behaviour can vary, and affect how student engagement is portrayed in scholarly articles. There are challenges in approaching engagement data both in on-site and online learning. On-site data collection often uses one data-point from self-reports or observations to represent a lesson, week, course, or semester (Henrie et al., 2018). Online learning, while collating longitudinal sequences of actual behavioural data have to combine this system trace data with multimodal data, to avoid being unidimensional and limited to system engagement (Bergdahl, forthcoming).

Table 1. *Examples of Engagement Indicators for Digital Learning*

Behavioural engagement	**Emotional engagement**	**Cognitive engagement**	**Social engagement**
Participation/ involvement	Enthusiasm	Curiosity	Asking for help
Attending lessons	Positive attitude	Critical thinking	Interaction with peers
Task completion	Satisfaction	Self-regulation	Interaction with educators
Assuming responsibility	Pride	Reflection	Interaction with tech
Effort	Enjoyment	Focus/concentration	Caring for others
Time on task	Interest	Deep learning	Turn taking
Positive study habits	Sense of wellbeing	Setting goals	Shared knowledge building
Positive conduct	Excitement	Understanding	

Table 2. *Example Disengagement Indicators*

Behavioural disengagement	**Emotional disengagement**	**Cognitive disengagement**	**Social disengagement**
Dropping out	Anger	Apathy	Decreased interaction
Time off task	Boredom	Confusion	Feeling isolated
Avoidance	Disinterest	Distraction	Challenging interactions
Absence	Frustration	Helpless	Withdrawing
Half-hearted	Lack of confidence	Opposition/rejection	Social anxiety
Poor conduct	Sadness	Pressured/stressed	Indifference
Lurking	Worry/anxiety	Unfocused/inattentive	
Task incompletion	Dislike	Unwilling	

Measuring behavioural engagement is arguably the easiest. This is primarily due to its more tangible and observable indicators, such as attendance and participation (Bond et al., 2020) or analysing system trace data like frequency/duration of video views online, access to key e-resources (Brown et al., 2024), or inactivity or responses to nudges (Bond et al., 2023; Brown et al., 2023a). This is supported by a scoping review (Bond et al., 2020) of 243 studies that explored student engagement with educational technology. The study revealed that behavioural aspects were the second most evaluated (36.6%, $n = 90$), following affective learning processes (57.3%, $n = 141$). Nonetheless, examining only one or two dimensions in isolation may offer limited insights, hindering a deeper, more comprehensive understanding of student engagement (Saqr et al., 2023).

Behavioural Dimension

Behavioural engagement refers to actions that support learning, or evidence of behaviour that support learning. This dimension of engagement tends to be the most visible, being directly impacted by teaching methods, digital technologies, and the mode of education

and learning. Behavioural disengagement can be manifested as a decrease in engagement quality, such as passive participation, or 'lurking' in terms of 'being present online' but not directly participating in an online environment. Other examples could include reflecting moral disengagement (e.g., cheating), or be referred as the absence of expected engagement: "that which is not happening" (e.g., avoidance, time off task, procrastination). In learning management systems, behavioural engagement would also include behaviour related to a total online session time (such as an online tutorial), the materials accessed in relation to weekly content or assessment preparation (Walsh et al., 2021), as well as students contributing to online discussions (Wilkinson et al., 2019). Tracking and supporting the behavioural aspects of engagement can be used as insights into previous engagement (test results) or disengagement (e.g., task incompletion, absence, dropping out), as well embraced as proactive control measures to motivate and 'nudge' positive engagement.

Emotional Dimension

This refers to students' emotional responses towards learning, such as interest, enjoyment, motivation, or a sense of belonging. Emotional engagement is critical as it underpins the willingness to participate and persist in learning activities. Disaffection (or emotional disengagement) refers to feelings of boredom, indifference, sadness, worry, anxiety, and frustration. The emotional dimension of engagement in digital learning have been explored through various studies. For instance, an analysis of student feedback highlighted instances where learners felt proud due to the integration of a leaderboard ranking system in their online courses (Alam et al., 2023). Additionally, Cerro Martinez (2020) examined how satisfaction in digital learning environments could be influenced by such gamified elements. Moreover, the role of emotions such as anger, disgust, fear, and sadness has also been considered, with negative joking (Huang et al., 2021) being one factor that could evoke these emotions in students (Kim et al., 2021).

Cognitive Dimension

Cognitive engagement pertains to the focus, and concentration directed to understanding and mastering a subject, knowledge creation, and cognitive regulative aspects such as planning, organising, and evaluating. Most commonly, self-regulation is linked with cognition, however, the ability to regulate is also important for emotional, behavioural, and social engagement. Cognitive disengagement includes distraction, opposition, and confusion, and can either be deep or shallow. In online learning, the cognitive dimension has, for instance, been approached as self-regulation including student preparation and postponement (Tempelaar et al., 2018), response times and attention to self-assessment items (Papamitsiou et al., 2020), as well as how students concentrated when recording audio.

Social Dimension

Social engagement is partly about asking for help, helping others, collaborating, and otherwise interacting with peers and teachers for academic purposes. But it also adds the aspect of co-creation, socially shared regulation, and shared cognition visible when students participate in activities that contribute to the collective understanding of a subject or project. Social disengagement includes withdrawal, not caring about others, and social anxiety, and it may manifest as an increased reliance on the teacher to replace peer interaction. Importantly, students with social anxiety who study online, may choose the online mode to be able to complete their schooling (Bergdahl, 2022a). Approaching engagement (and disengagement) in online learning, the social dimension could be approached through analysing student activity and assistance seeking from instructors (Bessadok et al., 2023) and interaction with adaptive technologies, *or* comparison of synchronous, synchronous interactions and use of physical resources (Summers et al., 2023).

Fostering Engagement and Building Capacity

The role of curricula and learning activities, particularly when integrated with technology, is pivotal in fostering student engagement. There is ongoing debate about the digitalisation of education as a dichotomy, where one side argues that computers (or tablets, smartphones, or AI assistants) are harmful for learning, and the other side argues that they have potential. Instead, energy should focus on the equitable provision of technology in educational settings (whether it be in school or higher education contexts), the capacity and features afforded by these technologies, the expertise and capacity of teachers in using these technologies in their teaching, and the fine balancing of human and technological resources.

While the curriculum may specify the mode of educational delivery, "...the mode of instruction online, blended or in person, does not affect the quality or the outcomes, but the design of the instruction in any modality does" (Moore & Barbour, 2023, p 12). The incorporation of digital technologies into learning environments compels educators to strike a delicate balance between their creative instincts and the necessity for pre-planning. In addition, teachers need to consider scenarios in which technology may take on different and overlapping roles (Sjöberg et al., 2023), where they can guide and assist learning differently, depending on whether they are used as tools to learn *with, through* or *via* (Bergdahl et al., 2024; Bond et al., 2024). Technology can also be used to foster social engagement by enabling (peer-to-peer, or technology-student) interaction, collaboration, group projects using digital platforms, which may help develop students' social skills and sense of support (Bergdahl & Hietajärvi, 2023).

Engagement is significantly influenced by the way curricula are manifested, and the learning activities are designed and delivered. However, it is not only critical to design for engagement, but also to build student engagement capacity. A pedagogical strategy that aims for students to acquire their level of ideal engagement does not focus solely on the

momentary engagement needed (see Symonds et al., this volume). For instance, instead of imposing arbitrary limits on over-engaged students who may submit excessively long papers, a more effective strategy involves engaging in reflective dialogue (Bergdahl, 2022a). In building student engagement capacity, it is imperative to look beyond the immediate needs of engagement required at the moment, towards the ideal for the individual student.

Applications of the SEDL Framework

The SEDL framework was first introduced in a conceptual article (Bond & Bedenlier, 2019) and has since been used within a range of research, primarily related to learning with digital technologies. A selection of these research studies are highlighted below, to further demonstrate how a socioecological approach can provide deeper insight into how engagement manifests within different contexts.

Flipped Learning

The SEDL framework was adopted in studies that explore student engagement in flipped learning, a student-centreed instruction approach in which what is traditionally done in class and homework are flipped (e.g., Gile et al., 2023; Ribeirinha & Silva, 2024). Interestingly they illustrate how collaborative activities, and the integration of technology, can significantly enhance learning experiences, underscoring the importance of interactive learning environments. Howard (2024) points to the necessity of supportive teacher-student interactions in virtual settings, emphasising the socio-ecological model's relevance in dissecting the interplay between individual attributes and broader systemic influences. Further studies (e.g., Heilporn & Lakhal, 2021; Wilford, 2023) explored one-to-one laptops and flexible instructional modes (combining on-site and online delivery), uncovering how digital technologies and flexible learning modes can be employed to inform the fostering of engagement, whilst also recognising potential pitfalls such as distraction.

These insights suggest a complex relationship between technology use and student engagement, mediated by factors including pedagogical strategies, the learning environment, and individual learner characteristics. The overarching narrative of these studies adopting the SEDL framework is the importance of adopting a holistic approach to educational technology and pedagogy. One that considers the layered and interconnected factors affecting student engagement, in particular social engagement, as manifested in interactivity and relationships. This, in turn, advocates for a balanced approach to learning, considering *how* to balance relational, physical, and digital resources to support student engagement in learning.

Online Learning/Emergency Remote Education in K-12

Focusing on K-12 online learning, Jones (2023a) used the SEDL framework to explore the impact of technology on parental engagement using an online communication channel for parents. They noted that workshops focusing on both technology and the fostering of parent-teacher relationships significantly increased parental involvement, which in turn influenced student engagement. In studies reflecting emergency remote teaching (ERT) during the COVID-19 pandemic, the SEDL framework was adopted for example by Roman et al. (2022) who highlighted how secondary school teachers, influenced by trauma-informed teaching practices, significantly shifted their focus toward the affective and social dimensions of learner engagement. This adjustment reflects a deepened appreciation for the emotional and social support necessary in virtual classrooms, underlining the critical role of teachers' awareness and proactive measures in fostering student engagement during a crisis. Tay et al. (2021) provided an exploratory examination of Singapore mathematics teachers' adaptation to online learning. They noted the challenges and strategies in managing technological, pedagogical, and engagement issues, stressing the importance of synchronous and asynchronous learning modes, teacher collaboration, and the role of parental support.

Online Learning in Higher Education

Moving to higher education and student engagement within online learning, the SEDL framework was used to explore different ecological levels. Starting with micro-level interactions, Daher et al. (2021) explored the role of learner-learner, learner-instructor, and learner-content interaction on affective engagement within an online mathematics course, emphasising the role of interaction quality. Connecting societal impact to micro level engagement, Ferguson (2024) addressed student interaction during the COVID-19 pandemic, focusing on the essential nature of supportive teacher-student relationships in maintaining engagement amidst challenges.

Extending the adoption of the SEDL framework further, Jones (2023b) conducted a comprehensive examination of the educational ecosystem's role in supporting student engagement within asynchronous online courses. Through a quantitative-correlational study, Jones explored the interconnectedness of community, comfort, facilitation, interaction, and collaboration as pivotal elements that foster a conducive learning environment. The study concluded that instructional design and the facilitation of learning by teachers are key, including how the course is structured, the availability and quality of interactions between students and instructors, and the support mechanisms in place for learners navigating the online environment. Additionally, the study pointed out the importance of interaction and collaboration to promote a sense of belonging, support, and a sense of community. Together, these perspectives advocate for future research to explore the nuanced interactions within educational ecosystems, aiming to develop strategies that more effectively harness technology’s potential to support diverse and engaging learning experiences.

Developing the SEDL Further

An important aspect of Bronfenbrenner’s ecological model (1979) not originally referred to, but more comprehensively considered in his later work was the ‘the influence of

time' (the chronosystem) (see Bronfenbrenner, 1994 and later work by Bronfenbrenner and Morris, 2006). This ecological aspect of engagement was also not initially represented in the SEDL framework. This system recognises the contexts and ecology of which individuals move and live in, is also made up of their life history, background, and prior lived experiences. These temporal factors that have occurred across and through time, influence one's perception of and response to the world. This means that students' past beliefs, experiences, and expressions of engagement have the potential to shape their future engagement (see Archaumbault et al., this volume), but this system also acknowledges the way that behaviours, attitudes, and practices vary through time. Considerations of factors situated at the chrono level also recognise the potential for the cumulative impact of past lived experiences, and potentially even the intergenerational factors that impact on individuals.

According to Skinner et al. (2022), time is one of the four key components within students' complex social ecology of academic functioning and development, incorporating three-time scales: micro-time, meso-time, and macro-time. Micro-time is about looking at how events are connected or disconnected from one another during short, ongoing moments or interactions. Meso-time refers to observing how interactions or events repeat or cycle through longer periods of time, such as days or weeks, and macro-time refers to broader social or historical events and changes.

While not always informed by engagement theories, temporal aspects are considered in research on online engagement. This includes examples such as time spent on course materials and quiz activities (Strang, 2016), timing of resource access (Walsh et al., 2021), the intensity and duration of engagement with learning activities, or focusing on apprehension, for example towards writing by exploring the frequency of long and short pauses and lengths of essays. Incorporating micro-time, meso-time, and macro-time into

research strategies, offers a systemic enhancement of our understanding and measurement of student online academic engagement.

As mentioned, the SEDL framework expands on the conceptual article by Bond and Bedenlier (2019), with the intent of providing a comprehensive framework to understand and address the multifaceted nature of factors that influence student engagement, especially in the context of digital learning. Since its inception, the framework has been employed across a broad spectrum of theoretical, primary, and secondary research, illuminating the complex dynamics of engagement in a range of different contexts. This breadth of application underscores the model's versatility and its capacity to shed light on the nuanced interplay of factors that influence student engagement, from individual to systemic levels.

Focusing on the SEDL framework, this chapter has gone some way in exploring and thinking more deeply about the complexity of student engagement. It has particularly focused on the interconnected, multidirectional milieus in which factors influencing student engagement are situated. Further, attention has been directed towards another important aspect of the ecological system: the temporal element, referred to as the chronosystem. This inclusion enriches our understanding by highlighting how temporal changes—both immediate and over the lifespan—affect engagement, acknowledging that student engagement is dynamically influenced by both the environment and time.

Implications for Policy and Practice

While this chapter has explored details of the SEDL framework, there are many ways in which it can have application and implications for practice, and the future direction of policy. A key implication of the framework for digital learning, particularly online learning and supporting student online engagement, is raising the consciousness of and the importance of considering the critical nature of the background and prior lived experiences of students,

and the responsibility that teachers of online courses have to ‘know thy students’ (see Hickey et al., this volume). Background information on students is increasingly available for teachers as part of key student reports that can be run through learning management systems.

While our initial thoughts may be that this task would be significantly time-consuming, and one that would go beyond the remit of most teachers, these types of considerations and tasks open the door to the possibility and application of AI to support in gaining insights into this type of data. This type of microsystem information potentially includes the age of students, first in family, entry-level and prior learning/degrees, part time/full time, and location. While this may be more challenging in online courses, key data and reports can help to group or cluster students in efforts to betters support and provide clarity in gaining a background understanding of the cohort of students being taught.

In terms of policy and practice there is an opportunity for educational institutions and teachers to nuance teaching and demonstrate how consideration for student background is evidenced in a range of practices. This may include putting proactive measures in place, contacting students, and offering support for assignment writing. Teachers may draw upon learning analytics data in combination with student background reports to nudge students to foster proactive study habits and practices, highlight key materials or target dates for them to keep in mind (Brown et al., 2023a). The SEDL framework also reinforces the importance of getting to know students earlier in the semester throughout the learning cycle. The implications of this are to ensure online learning practice integrates a range of social and collaborative engagement opportunities within the online learning cycle (Brown et al., 2023c).

In sum, sociocultural theory highlights the critical role of social interactions, language, and culture in shaping our cognitive abilities. By understanding the principles of sociocultural theory, educators can design more effective learning environments that consider

their students' social, cultural, and historical contexts, fostering more meaningful learning experiences: social interaction and collaborative learning. Given the interconnected nature of these factors, it may be useful to view student online engagement from a socio-ecological perspective. The socio-ecological perspective considers individual, interpersonal, community, and societal influences on behaviour and outcomes, acknowledging that these levels are interrelated and mutually reinforcing. This way, the socio-ecological perspective can add depth to our understanding of online student engagement, highlighting the dynamic interplay of individual, social, and technological factors.

Considerations for Future Research

While the exploration of student engagement through the SEDL framework has provided valuable insights, a notable gap remains in the existing educational technology research. In addressing this shift, it becomes imperative not only to expand our focus towards facilitating engagement more effectively and equipping students with the skills necessary to engage and re-engage, but also to support them in expanding their capacity to engage and adopt an expanded focus that considers the practices and context that best support this. With the rise of hybrid and online learning modes, it is essential to understand how diverse strategies and designs are needed in different learning environments and for different future needs. As schools are likely to increasingly adopt intelligent agents or AI-assistants, learning systems with integrated AI, and digital collaboration tools, future research could aim to explore engagement from multiple angles across the SEDL framework, embracing the multifaceted nature of engagement, rather than isolating these dimensions. Specific questions could be:

- How does the integration of AI in education impact student engagement, and what implications does this have for the microsystem and mesosystem levels of student interaction?
- What strategies can educators and policymakers employ to foster lifelong engagement, considering the evolving dynamics at the meso and macrosystem levels to support active and meaningful engagement beyond traditional academic contexts?
- How can using one integrated learning management platform affect student and parent engagement in lower socio-economic areas?

Furthermore, the inclusion of the chronosystem within the SEDL framework underscores the importance of considering temporal factors in our investigation and proactive understanding of and support for student engagement. Future studies should examine how the timing of interventions, the developmental stages of learners, and historical changes in educational practices impact engagement over time. This perspective is vital for understanding the longitudinal effects of educational technologies and the evolution of engagement as learners progress through their educational journeys.

In a similar vein, it would be of interest to further explore the temporal nature(s) of motivation, often stimulated in situ, and engagement, often pre-designed for. Particularly in relation to teaching practices and their engagement and motivation strategies. For example, some teachers who struggle with online teaching may rely heavily on being able to enthuse their students on-site. Equally important is the need to investigate the equity dimensions of digital learning. Future research should explore how access to technology, socioeconomic status, and cultural backgrounds influence engagement, aiming to identify strategies for creating more inclusive and equitable educational technologies (Australian Government, 2023).

In summary, the future of research in student engagement within digital learning environments should be grounded in a comprehensive theoretical framework that acknowledges the complexity of engagement. By considering the multifaceted, temporal, and contextual aspects of engagement, as well as the emerging role of technological agents and artifacts, researchers can contribute to the creation of more engaging, effective, and equitable educational experiences.

Conclusion

In this chapter, we have navigated the complexities of student engagement through the lens of the Student Engagement in Digital Learning Framework (SEDL). We have considered the intricate dynamics of engagement, advocating for an integrated approach that considers behavioural, emotional, cognitive, and social dimensions within the ecological spheres influencing learning. As we advance, the interplay between digital technologies and student engagement emerges as a critical focus area. It is imperative not just to facilitate engagement but also to empower students to navigate and re-engage in their learning landscapes, amidst the proliferation of digital tools and resources. As such, the pursuit of understanding student engagement demands continuous reflection on the theoretical underpinnings that guide our research and practice. By embracing a holistic view of engagement, informed by the SEDL framework, and attentive to the evolving digital educational environment, we can better support diverse learners in achieving meaningful and sustained engagement in their educational journeys.

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