Digital Engagement and Academic Functioning : A Developmental-Contextual Approach

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Digital Engagement and Academic Functioning – a Developmental-Contextual approach

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Abstract

The digital revolution since the turn of the millennium has opened up a new layer of opportunities for adolescents to participate, create and learn. Simultaneously, there has been an increase in both debate and concerns regarding how intensive utilisation of digital media affects students' academic performance, engagement and school-related well-being, that is, academic functioning. Students' continuously evolving digital practices are not always in congruence with the more traditional ways of doing schoolwork, although they flourish and fulfil their potential when the informal and formal practices of learning reach congruence. Spending time with digital media can provide new avenues for learning and development, but it can equally well divert young people from their studies. In this narrative review, we address these continuities and discontinuities between engagement with digital media and academic functioning for school-age children and young people, focusing on meta-analyses, reviews and key studies. We integrate two theoretical approaches, the concept of connected learning and the Differential Susceptibility to Media Effects Model and propose a Developmental-Contextual Model of Digital Demands and Resources, which emphasises the importance of accounting for the individual differences and developmental stages of students regarding media effects in the academic context. We conclude, based on the current evidence, that the average effects of digital engagement on academic functioning are negligibly small but heterogeneous, further corroborating the need to examine the qualitative differences in students' digital engagement, the developmental and individual differences between students, as well as the contextual interplay.

Digital engagement and academic functioning –

A developmental-contextual approach

Introduction

The question of whether today's children and young people feel disengaged from more traditional schoolwork (Ito et al., 2013) or whether they represent a generation that has been socio-emotionally destroyed because of the introduction of mobile technologies (Twenge, 2017) has already been debated for some decades. According to a series of surveys mapping the digital engagement of children and young people, we do know that they are going online more, at younger ages, in more diverse ways, and using smartphones as the primary source for online activities (EU Kids Online, 2014; Global Kids Online, 2019: Smahel et al., 2020). A total of 89% of US teens reported using the internet at least several times a day (Anderson & Jiang, 2018), while watching videos, listening to music, sending messages to friends and family, using social media sites and playing online games are the top digital activities that children and young people engage in online (Smahel et al., 2020). In this review, we refer to digital engagement as a broad concept of digital participation, which is not dependent on a specific technological device, platform, or tool.

From the viewpoint of learning or academic functioning, by which we mean both academic performance and academic well-being, the discussion on "digital natives" and "media effects" has been largely dominated by two approaches. The first focuses on the possible learning benefits of intensive and complex digital participation (e.g. Barron, 2006; Ito et al., 2020), followed by the suggestion that many of these benefits are underutilised in, or unconnected to, traditional schoolwork (e.g., Hietajärvi et al., 2016; Ito et al., 2013). In the early years after the concept of "digital natives" emerged, the discussion was thrown into what was referred to as a "moral panic"

(Bennett et al., 2008; Evans & Robertson, 2020) centred on the notion of "digital immigrant" teachers not using the same language as their "digital native" students (Prensky, 2001; Bennett & Maton, 2010). This turned out to be an exaggeration. However, even though digital tools have been available in educational settings for more than two decades now, children and young people report that much of their digital engagement occurs in informal, out-of-school contexts (Smahel et al., 2020). Fewer than 30% of students aged 9–17 years report using the internet at school at least once a week (Global Kids Online, 2019), and on average only 31% use the internet for schoolwork (Smahel et al., 2020). It is worth mentioning that the worldwide Covid-19 pandemic has forced educators to implement digital solutions in learning processes, which have increased and developed the use of digital solutions in learning. The second approach has focused on the (mainly negative) mental health effects (i.e., depressive symptoms, loneliness and anxiety) that time spent with digital technologies has on children and young people (Orben & Przybylski, 2019), which, again, has reached new moral panic proportions, reflecting what is referred to as the "Sisyphean cycle of technology panics" in psychology (Orben, 2020a).

Both positive and negative outcomes can emerge when children and young people engage with digital media (Allen et al., 2014; Hur & Gupta, 2013). Most of the discussion has centred on social media or digital gaming. In the public discussion, the harmfulness of digital engagement is often justified, claiming that it linearly and considerably displaces such important activities as sleep or physical activity. Research indicates that this claim is inaccurate at best (Dienlin & Johannes, 2020; Melkevik et al., 2010; Orben & Przybylski, 2019) and the evidence on the effects of digital engagement on adolescent psychological well-being seems to point to negligibly small but heterogeneous effects (Orben, 2020b; Odgers & Jensen, 2020). Researchers so far highlight the importance of differentiating between the various types of digital technology use (Areepattamannil

& Khine, 2017; Howard et al., 2016), as well as aiming to disentangle the direction of the effects in different social and developmental contexts (see Stavropoulos et al., 2021, in this special issue).

From a broader point of view, there appears to be a lack of theoretical foundations underlying the empirical studies aimed at uncovering digital media effects (Orben, 2018), and a similar conclusion can be drawn from the educational point of view. The main body of research seems to have been concerned with correlating "screen time" with academic outcomes, with little attention given to the motives or content of said time with screens (Orben, 2020). To that end, in this narrative review we address meta-analyses, reviews and key studies focusing on the direct and indirect relations of digital engagement with academic functioning, as well as the direction of these effects. Moreover, the review of empirical findings is addressed in conjunction with the possible psychological interpretations, utilising our *Developmental-Contextual Model of Digital Demands and Resources.*

Our aim is to synthesise concurrent theories and empirical findings that can be used to interpret the interplay between digital engagement and academic functioning, rather than only examining the linear effects of time spent with technologies. We begin by highlighting that young people's digital engagement is not homogeneous regarding methods of usage and the related predictors and outcomes. After that, we present our *Developmental-Contextual Model of Digital Demands and Resources* (DC-DDR), which is based on the demands-resources model related to studying (Salmela-Aro & Upadyaya, 2014). In the DC-DDR, the role of digital technologies in academic functioning is dependent on the digital resources and demands of young people (Hietajärvi et al., 2019). Further, the resources or demands are expected to be dependent on the developmental stage and informal and formal contexts. We integrate two theoretical approaches, the concept of connected learning (Ito et al., 2020) and the *Differential Susceptibility to Media Effects Model* (DSMM; Valkenburg & Peter, 2013) into the DC-DDR. More broadly, following

socio-cultural theories in the concept of connected learning, the role of digital engagement is conceptualised as interacting with mediating tools in a broader ecology of learning situated across contexts (Kumpulainen & Sefton-Green, 2014) and driven by the variation in young people's pervasive digital interests (Kruskopf et al., 2021). As such, at the contextual level, the academic outcomes are the results of the interactions within the young people's learning ecologies, thus adding a socially shared contextual determinant to the media effects. In the *DSMM*, the underlying assumption is that beyond qualitative effects in the media engagement content, the resulting media effects differ between individuals (Beyens et al., 2020) because of different developmental dispositions and goals, as well as individual psychological conditions and social contexts that influence the associations (Valkenburg & Peter, 2013). The DC-DDR aims to incorporate both of these theoretical approaches as boundary conditions into the research on digital engagement and academic functioning.

Multidimensional digital engagement among young people

There are approximately 3.5 million apps available in Google Play and 2.2 million in Apple Store (https://www.statista.com/statistics/276623/number-of-apps-available-in-leading-app-stores/, retrieved 13.1.2020), providing young people with endless opportunities to tailor their digital media experiences. No two media experiences are identical (Reeves et al., 2020), and assuming fixed effects of time spent with any digital media will apply to all young people seems implausible.

Young people's different digital activities can be categorised based on two differing but overlapping practices or genres of digital engagement (Ito et al., 2010): those that are *friendship-driven,* that is, using technologies to maintain and deepen already established social connections, and those that are *interest-driven,* that is, utilising modern technologies to learn and engage in activities based on a specific object of interest. Digital activities are social in the sense that they

involve direct or artifact-mediated networking interaction and participation in culturally mediated activities (Hakkarainen et al., 2015; Hietajärvi, 2019; Ito et al., 2010). The majority of adolescents mainly engage in friendship-driven activities (e.g., interacting with friends) to a moderate degree, and only a relatively small minority seem to participate frequently in more demanding or interest-driven digitally mediated activities (Eynon & Malmberg, 2011; Hietajärvi, 2019; Rosenberg et al., 2018). Another simple, yet useful analytical distinction would be to separate active (i.e., aiming to interact with another user) and passive (i.e., consuming digital content by watching content made by others) use of digital media (Beyens et al., 2020, Orben, 2020b). Digital engagement can be further divided into private or public activities. Private digital engagement refers to activities that are not seen by all other users (i.e., sending private messages to a friend), and public refers to engagement where the user is openly engaging in the digital platform (e.g., commenting on a post or publishing a video on YouTube) (Valkenburg et al., 2022).

It is apparent that both the practices of digital engagement and the related competencies of children and young people are, and have always been, far from uniform (Bennett & Maton, 2010; Haddon et al., 2020; Valkenburg & Peter, 2013). The literature on digital natives has long since shown (e.g., Bennett & Maton, 2010) that such homogeneous generations (individuals with identical ways of engaging in the digital world) do not exist (Evans & Robertson, 2020), and that despite strong claims, there seems to be no evidence linking digital media to the demise of young people (Odgers & Jensen, 2020). Regarding individual differences, among the heterogeneous generation of digital natives, the type of digital engagement (be it educational, use of social media, digital gaming or active/passive and/or private/public) is an important moderator that can differentiate the link between digital engagement and academic functioning (see also Stavropoulos et al., 2021, in this special issue).

In addition, social contexts influence the digital engagement of adolescents as they derive many of their digital practices and much of their wellbeing from peers (Livingstone & Haddon, 2012; Masten & Motti-Stefanidi, 2020). The ways in which adolescents engage online are mixed, and only investigating what digital engagement does to young people assigns a very passive role to adolescents and downplays the pre-existing psychological traits and susceptibilities. Studying how adolescents engage online, and how they feel and think about it, reveals more information about the effects (Dienlin & Johannes, 2020).

Theoretical perspectives to disentangle the complex interplay between digital engagement and academic functioning

There is a need to shift the focus of research beyond screen time. What this entails is focusing on both the variation in the ways in which and reasons why young people engage with digital technologies, as well as the complex interplay between diverse ways of engaging with digital tools and learning, academic adjustment, or academic well-being. Simply assessing minutes spent with a digital device cannot yield thorough answers. Moreover, a developmental and contextual model, which attempts to explain why some types of digital engagement may yield certain outcomes specifically in certain academic situations, is needed. Such models, which comprehensively explain the individual differences among young people in digital media use, do exist (i.e., *the Cyber-Developmental Framework* introduced by Stavropoulos and colleagues, 2021, in this special issue), and our aim is to deepen the current literature and understanding by presenting an overlapping model (DC-DDR) that highlights the academic context in particular.

The Developmental-Contextual Model of Digital Demands and Resources (DC-DDR)

The effects of digital engagement on students' academic functioning can be approached from the theoretical framework of *the school demands-resources model* (Salmela-Aro & Upadyaya, 2014) adjusted for digital engagement rather than school engagement. In line with this model, the DC-DDR asserts that the possible negative outcomes from digital engagement result from an imbalance between the psychological or social demands and the resources available to overcome these demands (Demerouti et al., 2001). The demands require psychological effort and are consequently related to psychological costs (i.e., strain). Resources are features that are functional in achieving personal goals reducing the demands and the psychological costs associated with them (Salmela-Aro & Upadyaya, 2014). Depending on the developmental phase and context, digital engagement can equally function itself as either a resource or a demand, or it can indirectly increase other resources or demands (Korunowska & Spiekermann-Hoff, 2020). Digital engagement may just as readily provide social resources, for example by increasing feelings of social support from peers, especially in adolescence (Allen et al., 2014). Utilising digital media to support schoolwork or develop digital skills (Smahel et al., 2020) can provide a sense of accomplishment and promote the academic functioning of students.

In line with the school demands-resources model, the DC-DDR approaches the imbalance between the available digital resources and demands through two processes, the energy-depleting process and the motivational process, and highlights the importance of investigating them as parallel processes (Salmela-Aro & Upadyaya, 2014). The energy-depleting process is linked to overtaxing and wearing out due to heavy demands that exhaust energy. In relation to digital engagement and academic functioning, this kind of process might occur if digital engagement takes too much time and/or effort, simultaneously displacing other important activities that promote academic functioning. For example, some frequent or intensive practices of digital engagement mediated by lack of sleep, for instance (Hale & Guan, 2015; Hökby et al., 2016), may lead to

increases in the daily demands in certain contexts, which can consequently lead to lower academic functioning due to overtaxing. The motivational process, in turn, refers to situations where the lack of sufficient resources hinders dealing effectively with heavy demands, which may lead to disengagement or foster mental withdrawal. The motivational process might occur if the informal digital practices are not consonant with the formal digital practices (see the concept of connected learning below). Among digital natives, the informal digital practices (i.e., how to use social media) are often more advanced than the formal digital practices (i.e., how to use Excel or PowerPoint effectively) (Global Kids Online, 2019; Smahel et al., 2020), yet the informal practices are often not acknowledged in the school environment and thus do not contribute to the sense of competence as a student (Hietajärvi et al., 2020).

Further, the interplay between digital engagement and academic functioning should be studied and reflected through theoretical assumptions that emphasise the individual differences and the developmental phase of the student (Valkenburg et al., 2016). The *Differential Susceptibility to Media Effects Model* (DSMM; see Valkenburg & Peter, 2013) has focused on the micro-level media effects. The DSMM assumes that media effects depend on the individual's pre-existing dispositional, developmental, and social susceptibility, and that the cognitive, emotional, and physiologically arousing state of the individual mediates the relationship between media use and media effects. Following the DSMM, we argue that similar engagement online can constitute a resource for one person and a demand for another due to the pre-existing conditions and susceptibilities (Dienlin & Johannes, 2020; Hollis, Livingstone, & Sonuga-Barke, 2020; Kardefelt-Winther et al., 2017). In line with the DSMM, the DC-DDR also emphasises the developmental phase of students moderating the media effects (Valkenburg & Peter, 2013). The outcomes of digital engagement should be viewed in relation to students' developmental stage and the key challenges related to that developmental stage. If the media effects vary between individuals within

the age group (Hietajärvi et al., 2020), it is likely that the effects will also vary between the age groups (Adelantado-Renau et al., 2019; Liu et al., 2017). Depending on the developmental stage of the student, motivations for usage and different digital practices are assumed to differ due to the different developmental tasks (Jackson & Goossens, 2020). In adolescence, digital engagement can be more socially oriented due to the desire to belong to a peer group, whereas among school-aged children digital engagement can be related to building up digital skills and competencies to put one on a similar footing to one's peers.

In the context of digital demands and resources, family, peers, or school community can work as a contextual social resource or demand (Upadyaya & Salmela-Aro, 2013). The way young people engage in the digital world influences the functioning and response of their school communities, peers, and family as well as the society they live in (Livingstone & Haddon, 2012). However, conversely, these social contexts affect how much and in what ways young people engage digitally (Livingstone & Haddon, 2012; Stavropoulos et al., 2021, see this special issue). Teachers, for example, have the power to plan learning processes by using digital solutions, and can correspondingly influence the methods and degree of digital engagement of their students. On the other hand, teachers might be more willing to invest in digital learning solutions if students show interest in digitally mediated learning. This would indicate a successful connected learning condition (Ito et al., 2013, 2020; Kumpulainen & Sefton-Green, 2012) where different contexts (informal and formal) are connected in a way that allows students to flourish and reach their potential. In the previous literature, connected learning has been defined as a process of connecting adolescents' self-regulated and interest-driven learning (Barron, 2006) across formal and informal contexts, in the reciprocal interactive processes between the learners and their social ecologies (Nardi & O'Day, 2000). Such a connected learning condition would be expected to be reflected in academic engagement and achievement – representing a contextual fit. Contrariwise, a condition

where students' informal competencies are not recognised or allowed to be implemented in schools, leading to experiences of withdrawal and disengagement (Hietajärvi et al., 2020; Rajala et al., 2015), would represent a misfit. Such a gap between formal and informal contexts might be evident in situations where, for example, a student is participating in online interest-driven communities and developing expertise on a topic not directly relevant to school (Kruskopf et al., 2020; Barron, 2006) and not given the opportunity to gain validation for such expertise in the traditional school environment. In the context of the DC-DDR, this could lead to disengagement at school because of the imbalance between digital demands and resources, and the misfit between the informal and formal contexts.

To sum up, the DC-DDR emphasises some key elements when making assumptions about the associations between digital engagement and academic functioning (see Figure 1). First, the developmental stage of students predicts and moderates the associations. Second, digital engagement can work as a social or personal resource or as a demand, depending on the individual and situational differences in media effects. Third, the informal and formal social and digital contexts construct either a fit or a misfit that provide conditions that either bring out the students' potential or dispel engagement towards studying. Last, an imbalance (or balance) between the available digital resources and demands, and the related outcomes, can be approached through two different but possibly parallel processes, the energy-depleting process and the motivational process.

The effects of digital engagement on academic functioning

Academic performance and digital engagement

Empirical evidence, overall and across studies globally, has shown that screen time as such is not associated with the academic performance of students (ES = −0.29; 95% CI, −0.65 to 0.08; k=18, Adelantado-Renau et al., 2019), whereas television viewing and video games have been

shown to have a negative association (ES = -0.19; 95% CI, −0.29 to -0.09; k=18), meaning that more time spent on television and video games is associated with lower academic performance. However, it is unlikely that the effects of digital engagement on academic performance are only linear (Przybylski & Weinstein, 2017). For example, Faught et al. (2017) reported non-linear associations: screen time was positively associated with academic performance when adolescents spent from 2 to 4 hours on screen-based activities, but a negative association was found when 7 or more hours per day were spent with digital screens.

The empirical findings supporting the notion that digital engagement can work as a resource in academic functioning suggest that using social media for academic purposes has a small positive effect in relation to academic achievement (ES = .08; 95% CI, 0.02 to 0.14; k = 10, Marker et al., 2018). Further, some results suggest that the use of social networking services has a weak positive effect (ES = .05; 95% CI, 0.00 to 0.10; k = 2) on literacy grades (Liu et al., 2017), or that educational or informational use of social media correlates positively with GPA among US and EU college students (Junco, 2012a; Karpinski et al., 2016). Although digital gaming is purported to have benefits in developing various competencies (Alho et al., 2022, in this special issue; Granic et al., 2014; Moisala et al., 2016a; 2016b), there appears to be little evidence of these being reflected in better academic performance (cf. Adelantado-Renau et al., 2019). However, strategic video games appear to predict academic achievement indirectly through more proficient problem-solving skills (Adachi & Willoughby, 2013). This indicates that, similarly to the findings in relation to social media, the possible positive effects of gaming depend heavily on the type of games played and the type of gaming itself (Ito et al., 2010; Ventura et al., 2012), and on whether digital engagement increases resources or demands. Further, qualitative studies have reported cases of adolescents developing complex high-level digital skills, sometimes all the way to professional level (Ito et al.,

2010; Barron, 2006), but connecting these to schoolwork is a pedagogical challenge not yet resolved (see Ito et al., 2013; Rajala et al., 2015).

Regarding demands, multitasking and being exposed to multiple distractions via digital technologies throughout the day are detrimental in terms of cognitive ergonomics (Alho et al., 2022, in this special issue; Firth et al., 2019) and, in general, heavier media multitaskers demonstrate poorer performance in some cognitive domains (Uncapher & Wagner, 2018). Doing multiple things simultaneously with digital media also appears to be related to lower academic performance ($r = -.10$, $k = 15$, van der Schuur et al., 2015; see also Lau, 2017; Marker et al., 2018) and less productive study-related behaviour or perceived learning (van der Schuur et al., 2015). Empirical findings supporting the viewpoint of additional demands in relation to schoolwork indicate that using digital media for social networking is, on average, weakly and negatively related to academic performance, mainly based on college student samples ($r_{weighted} = -.07$, $k = 34$, Huang, 2018; $r = -.08$, $k = 29$, Liu et al., 2017; $r = -.07$, $k = 55$, Marker et al., 2018). However, there is substantial heterogeneity in the original effect sizes between studies. In addition, Market et al. (2018) concluded that when the original studies had used objective measures of achievement, such a negative relation was not evident (see also Appel et al., 2019) and longitudinal evidence, however, does not indicate that multitasking would be directly or indirectly related to academic performance over time (van der Schuur, Baumgartner, Sumter, & Valkenburg, 2020). Nevertheless, a correlation between social networking and lower academic performance is supported by a finding that using social media up to the point of fatigue seems to correlate with lower academic performance (Malik et al., 2020), and that disturbed sleep due to social media use is related to lower academic achievement, suggesting that there is some kind of non-linear vicious cycle (Evers et al., 2020). Outcomes of this kind reflect the energy-depleting process of the DC-DDR (see Figure 1).

There are differences in the results when the educational level of students is taken into account, showing that developmental and contextual factors moderate the associations. Adelantado-Renau and colleagues (2019) showed that there were differences in the associations between children (4 to 11.9 years) and adolescents (12 to 18 years): television viewing or playing video games were not associated with composite scores among children, whereas both television viewing (ES = −0.19; 95 CI, -0.30 to –0.07, k=14) and video game playing (ES = −0.16; 95% CI, -0.24 to –0.09; k=7) were negatively associated with composite scores among adolescents. Liu et al. (2017) found that educational level moderated the effects of digital engagement and academic functioning: a non-significant association was found between social networking and academic performance among younger adolescents (middle and high school students) in comparison to older adolescents (college students), which showed significant negative effect sizes (ES = -0.09; 95% CI –0.16 to –0.01, k=23).

Separating different types of activities in social media indicates that specifically using social media for socialising with friends seems to correlate negatively with US and EU college students' grade point average (Junco, 2012a; Karpinski, et al., 2016). In particular, smartphone usage during class has been shown to have a negative impact on academic performance (Felisoni & Godoi, 2018). Bjerre-Nielsen and colleagues (2020), however, argue that this result might be overestimated by showing that, in their study, the estimated association between in-class mobile phone usage and course grades decreased substantially when they controlled for different fixed student and course characteristics (Bjerre-Nielsen et al., 2020). Gaming, on average, seems to have a small (ES = −0.15; 95% CI: −0.22 to −0.08, k = 10, Adelantado-Renau et al., 2019) or a minimally small (r = −.01; 95% CI, −0.04 to 0.01, k = 12, Ferguson, 2015b, see also Boxer et al., 2015; Furya-Kanamori & Doi, 2016; Valkenburg, 2015) negative effect in relation to academic achievement, or no relation at all (Sublette & Mullan, 2012). Further, the meta-analysis (Adelantado-Renau et al.,

2019; Ferguson, 2015a) results suggest heterogeneity in the effects (Adelantado-Renau et al., 2019; Ferguson, 2015a), as well as a possible publication bias towards selective publications that reported a harmful effect of gaming (Ferguson, 2015b). However, so-called problematic gaming seemed to be related to academic problems (Ferguson et al., 2011), and to longitudinally predict lower academic performance in Norwegian adolescents (Brunborg et al., 2014) and male US college students (Schmitt & Livingston, 2015). In that sense, the findings suggest that it is essential to differentiate digital activities that work as a resource, such as active gaming, from activities that increase demands, such as problematic or addiction-like gaming (see definition by Ferguson et al., 2011) (Brunborg et al., 2013; Ferguson et al., 2011; Griffiths, 2018; Krossbakken et al., 2018).

Students' individual differences, such as identity, personality or pre-existing dispositions towards schoolwork influence the type of digital engagement and related outcomes (Mannerström et al., 2018). Students scoring higher in extroversion seem to benefit from using digital media in terms of their academic performance (Naqshbandi et al., 2017), whereas students with a more maladaptive disposition towards school appear to engage more in social media (especially so for girls) or gaming (especially for boys) and also perform worse academically (Hietajärvi et al., 2015). In addition, students with more maladaptive dispositions towards school seem to be more susceptible to academic impairment due to digital engagement (Mädamürk et al., 2021). Loneliness seems to predict increasingly problematic internet use developmentally, which is then related to a decline in academic performance over time in adolescence (Tóth-Király et al., 2021).

Academic engagement, well-being and digital engagement

There is a considerably smaller body of research focusing on academic engagement and well-being in relation to digital engagement, compared to the research on digital engagement and the psychological well-being of young people. However, students' academic and general

psychological well-being are entangled (Kiuru et al., 2019). Several meta-analyses and systematic reviews have reported that the associations between time spent on social networking sites (Huang, 2017; Stiglic & Viner, 2019), video gaming (Ferguson, 2015a) or digital technology usage (Odgers & Jensen, 2020) and the psychological well-being of young people (Stavropoulos et al., 2021) are small and heterogeneous, on average. Some recent longitudinal findings suggest that time spent on social media does not predict depressive symptoms (Coyne et al., 2020; Heffer et al., 2019; Puukko et al., 2020) and technology use is not associated with adolescents' mental health symptoms (Jensen et al., 2019). For some, on the other hand, engagement in the digital world may lead to increased levels of anxiety and loneliness (Wu et al., 2016). In general, it seems that the well-being effects vary among adolescents (Beyens et al., 2020).

Qualitative case studies have unveiled students' informal (interest-driven) digital learning practices that can both facilitate and obstruct academic engagement (Deng et al., 2016; Gurung & Rutledge, 2014; Kruskopf et al., 2020). Larger-scale quantitative studies, albeit scarcer, point in a similar direction: some forms (e.g social networking) of digital participation are related to lower academic engagement, whereas others (e.g. knowledge-oriented) are related to higher academic engagement (Hietajärvi et al., 2019). Conversely, communicative activities have been found to be positively related to student engagement, whereas with non-communicative activities the relation seems negative (Junco, 2012b), indicating a misfit between the formal and informal contexts. However, the associations seem to be complex, and the definitions of both digital and student engagement vary.

In relation to digital and developmental differences in the academic context, a survey study from Canada with a sample of students from grades 7 and 12 (N=10,076) indicated that the developmental stage moderated the media effects, especially among older students (Sampasa-Kanyinga et al., 2019). The association between out-of-school social media use (time spent on

social media sites posting or browsing content) and school connectedness varied by age, showing a stronger association in students in grade 12 compared to students in grade 7 (Sampasa-Kanyinga et al., 2019). In line with and in addition to Sampasa-Kanyinga et al. (2019), Maksniemi and colleagues (2021) found (in a Finnish sample) that the longitudinal intra-individual associations between digital engagement and academic wellbeing varied across adolescence: social media use was not associated with school-related exhaustion in early adolescence, but a positive association was found in middle and late adolescence.

In relation to the DC-DDR and the energy-depleting process, heavy social media use (more than 2 hours) was negatively and regular use (2 hours or less) was positively associated with school connectedness and academic performance (Sampasa-Kanyinga et al., 2019). In addition, and related to the two parallel processes of the model, a study conducted in southeast England (N=217, mean age=12.57) showed that heavy players (playing >3hr daily) were more disengaged (assessed by teachers) in schoolwork compared to non-players (Przybylski & Mishkin, 2016). This shows that informal digital practices may lead to motivational disengagement at school because the connected learning conditions are not in congruence. On the other hand, heavy video game playing may displace alternative activities, duly decreasing resources and increasing demands.

In relation to the motivational process of the DC-DDR specifically, empirical findings from studies conducted in Finland indicate that lower school engagement may result from a condition whereby students have a desire to use digital devices for schoolwork, but do not have the opportunity to do so (Hietajärvi et al., 2020; Mädamürk et al., 2021). Similarly, students who feel cynical towards schoolwork might feel more engaged at school if they had the opportunity to make use of digital devices during lessons (Halonen et al., 2016; Salmela-Aro et al., 2016). This disconnection might lie in students' lack of opportunities to gain practice in technology beyond

pursuing personal interests (Wang et al., 2014). Nevertheless, more fine-grained research regarding such fit-misfit configurations between school and out-of-school learning environments is needed.

Research specifically focusing on academic well-being and digital engagement indicated that excessive internet use seems to predict later school burnout, and school burnout seems to predict later excessive internet use (Salmela-Aro et al., 2017). Similarly, it appears that school burnout predicts disturbed sleep due to using social media (Evers et al., 2020) as a possible coping mechanism. In addition, when differentiating digital activities and components of school burnout when looking for demands and resources, it seems that using digital media for social networking is reciprocally related to higher emotional exhaustion and higher cynicism towards schoolwork (Hietajärvi et al., 2019; Hietajärvi, 2019), whereas more active engagement in self-directed digital learning seems to predict higher student engagement (Hietajärvi et al., 2020, Rashid & Ashgar, 2016).

These longitudinal findings posit academic well-being both as an antecedent and an outcome of increasing digital engagement. Moreover, for girls, feeling emotional exhaustion, and for boys, feeling inadequacy as a student, seem to predict problematic Facebook use (Walburg et al., 2016), suggesting some form of differential susceptibility. Further, students with a more maladaptive motivational profile towards schoolwork showed greater risk of sleep impairment due to social media (Mädamürk et al., 2021). However, detailed analysis testing different components of digital engagement, and social and developmental contexts are lacking for academic engagement.

Discussion

In this narrative review, we have introduced the DC-DDR, which highlights that the possible negative outcomes of digital engagement result from an imbalance between the psychological or social demands and the resources available to overcome these demands. Digital

engagement can be built up as a resource or a demand, or indirectly influence other resources and demands depending on different developmental or contextual (informal and formal) factors. The model includes two parallel processes, the energy-depleting process and the motivational process, which can be used to better explain the multidimensional and complex topic. As the academic challenges and demands vary according to the educational level and stage of development, the associations between digital engagement and academic functioning should be studied in the right educational and/or developmental context.

From the viewpoint of the DC-DDR, some of the evidence so far suggests that academic or information-oriented digital engagement can provide resources which, if utilised, are reflected in better academic performance, engagement or well-being. On the other hand, multitasking with social media or a problematic type of gaming seems to be related to lower academic functioning. If digital activities are mainly displacing time from studying, researchers can expect there to be an association with lower academic performance. These associations can be explained through the energy-depleting process. On the other hand, digital engagement can increase disengagement towards studying if advanced digital skills and/or the readiness to use the skills at school are not recognised – reflecting the motivational process.

Considering the effects of digital media on academic functioning, it seems that the average effect sizes are mostly small, non-existent or non-linear, and certainly heterogeneous. The effects appear to be conditional on the type of media engagement and the students' developmental, personal or academic disposition, but studies systematically addressing these as moderators are still scarce. Nevertheless, based on the DC-DDR and the empirical evidence provided in this review, it seems that the time perspective (measuring how much time students spent on digital screens) is insufficient when investigating the digital media effects on academic functioning. The threshold between "moderate and excessive" use is not fixed and varies not only across different

developmental stages but also across contexts. Some studies indicate that even high engagement in digital activities (e.g., chatting continually with friends) does not necessarily produce negative outcomes (Brunborg et al., 2013), and may be useful when developing social relationships (Desjarlais & Willoughby, 2010).

Thus, the main takeaway from the summary of these findings should not be that digital media engagement is unrelated to academic functioning, but rather that the effects vary across conditions and subgroups. Small effects can indeed be interesting, important and worth further consideration in terms of specific subgroups for whom the effects might be larger (Valkenburg, 2015) in various social and developmental contexts (Stavropoulos et al., 2021). Such a subgroup in the school context could be, for instance, students engaged in interest-driven digital activities with opportunities to connect these to academic learning (Hietajärvi et al., 2020). However, as connected learning is anchored to interest rather than mere friendship-driven digital engagement (Barron, 2006; Ito et al., 2010; 2013), and only a minority of students can be identified as being engaged in such, the expected average effect at the group level would be small. It appears crucial to approach further examinations of the topic with the understanding that different orientations of digital engagement exist and contribute to both the actual activities that adolescents engage in, the social offline and online contexts they live in, and the outcomes that this behaviour entails. Exposure to the same digital media can cause very different responses depending on the user and the kind of social context and/or developmental stages in which they are involved (Valkenburg & Peter, 2013). While such interactions provide endless configurations, there is still much to be learned even with simple models combining the quality of digital engagement with individual characteristics and situations over simple fixed linear effects.

Limitations

This was not a systematic review, and hence some key findings might not have been covered. Further, the informativeness of this summary is reduced because the majority of the studies are based on samples of higher education students with an emphasis on students from northern America. Publication bias seems to influence some parts of the research, especially regarding the effects of gaming (Ferguson, 2015b). In addition, most of the studies have been cross-sectional in nature and reliant upon self-report data, which does not seem to correlate well with objective data in terms of the use of smartphones, for instance (Ellis, 2019). Thus, the conditional effects in terms of media content and the students' dispositional, developmental and social differences warrant further research with objective data, as well as more developed hypotheses and measures. Due to the limited number of longitudinal studies so far, the question of the direction of effects was only touched upon and should therefore be the focus of further meta-analyses and reviews.

Conclusions

Although students' digital engagement is a complex and multidimensional phenomenon, research has identified some more or less stable elements. The Developmental-Contextual Model of Digital Demands and Resources, introduced in this narrative review, emphasises focusing on diversity and the motivations for digital engagement alongside the developmental and contextual factors through which a certain type of digital engagement ends up increasing either demands or resources.

Aiming to resolve the discrepancies between in-school and out-of-school learning is not new (Rajala et al., 2015), but given the ubiquity of digital engagement in students' lives, it is perhaps more important than ever today. However, simply increasing the amount of time spent using digital tools in education does not appear to be the best way forward. Although many students are fluent in using technologies outside of school, the educational benefits are dependent on

pedagogical practices (Tamim et al., 2011; Yeung et al., 2021). Moreover, while research and policymakers are striving to overcome challenges related to the digital revolution, students are likely to benefit from support in equipping them to use digital media in a resource-yielding way rather than viewing digital media as a handicap to becoming a fully functioning adult (Hur & Gupta, 2013). The education system is in a key position to promote such digital competencies that liberate students to utilise digital tools to their benefit instead of having digital gadgets as mere distractions (Lonka, 2018). The differences in support (Barron et al., 2009) received by students are, however, likely to put them in unequal positions and create a digital competence or digital participation gap (Jenkins, 2009). To counter this, the education system should be prepared to provide all students with the necessary skills, and to cultivate the digital practices adopted by students as resources.

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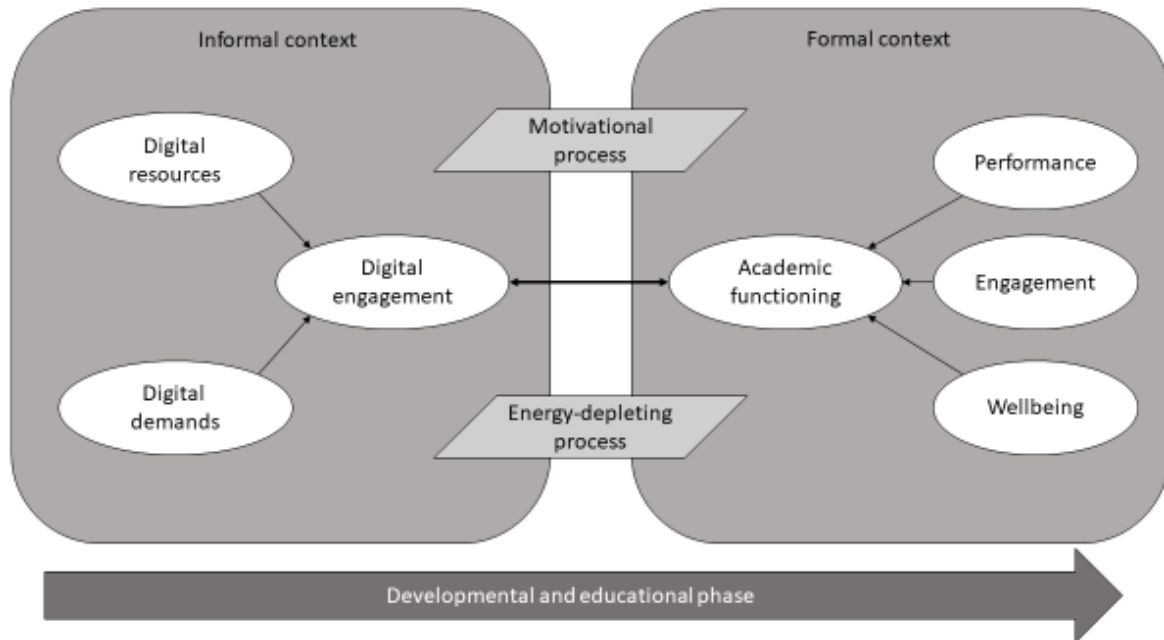Review,* 33. https://doi.org/10.1007/s10648-020-09592-4

Figure 1. The Developmental-Contextual Model of Digital Demands and Resources