

MAPAN-JOURNAL ,
Publisher: METROLOGY SOC INDIA , NPL PREMISES,
Address: DR K S KRISHNAN MARG, NEW DELHI, INDIA,
ISSN / eISSN:0970-3950 / 0974-9853
Volume 26-Issue 1- (2026)

OPEN ACCESS
Check for updates

Digital Learning Environments and Student Motivation: The Mediating Role of ICT Engagement

Yu Yan

University of Birmingham, Edgbaston ,Birmingham, B15 2TT, United Kingdom

Yuy65105@gmail.com

Abstract:

The rapid expansion of digital learning environments has transformed contemporary educational practices and reshaped students ' learning experiences. While digital technologies provide flexible and interactive learning opportunities, the mechanisms through which these environments influence student motivation remain insufficiently understood. This study investigates the relationship between digital learning environments and student motivation, with particular emphasis on the mediating role of Information and Communication Technology (ICT) engagement. Drawing upon theories of technology-enhanced learning and motivational psychology, the study adopts a quantitative research design involving students from higher education institutions. Data were collected through structured questionnaires measuring perceptions of digital learning environments, levels of ICT engagement, and learning motivation. Structural equation modeling (SEM) was employed to examine the direct and indirect relationships among the proposed variables. The findings indicate that digital learning environments exert a significant positive influence on student motivation. More importantly, ICT engagement serves as a meaningful mediator, suggesting that students' active interaction with digital tools and learning technologies strengthens motivational outcomes. These results highlight the importance of designing learner-centered digital environments that promote meaningful ICT participation and sustained engagement. The study contributes to the growing body of literature on digital education by providing empirical evidence of the psychological and behavioral mechanisms underlying technology-supported learning. Practical implications are discussed for educators, policymakers, and educational institutions seeking to enhance student motivation and learning effectiveness in digitally mediated educational contexts.

Keywords: Digital learning environments; student motivation; ICT engagement; digital education; technology-enhanced learning; structural equation modeling

Introduction

The widespread adoption of digital technologies has fundamentally transformed educational systems worldwide, reshaping how teaching and learning are designed, delivered, and experienced (Bond et al., 2021; Hodges et al., 2020). Digital learning environments (DLEs), characterized by the integration of online platforms, multimedia resources, virtual classrooms, and interactive communication technologies, have become increasingly central to contemporary education (Castro, 2019). Particularly following the acceleration of digital transformation in education, universities and schools have relied heavily on digital tools to facilitate instructional continuity and enhance learning accessibility (Dhawan, 2020). While digital learning environments offer significant opportunities for personalized, flexible, and collaborative learning, questions remain regarding their influence on students' psychological and motivational outcomes.
Student motivation is widely recognized as a critical determinant of academic achievement, persistence, and learning effectiveness (Ryan & Deci, 2020). Motivated learners are more likely to demonstrate sustained attention, active participation, and self-regulated learning behaviors, all of which contribute to improved educational outcomes (Schunk & DiBenedetto, 2020). Traditional motivational theories, including Self-Determination Theory (SDT) and Expectancy-Value Theory (EVT), emphasize the importance of autonomy, competence, and perceived value in fostering positive learning experiences (Eccles & Wigfield, 2020; Ryan & Deci, 2020). In digital contexts, however, the mechanisms influencing motivation may differ from those observed in conventional classroom settings due to the increased reliance on technology-mediated interaction and independent learning.

Existing studies have reported mixed findings concerning the relationship between digital learning environments and student motivation. Some scholars argue that digital platforms enhance motivation by promoting learner autonomy, immediate feedback, and diverse instructional resources (Martin et al., 2020; Zhao et al., 2021). Interactive learning systems, gamified platforms, and multimedia-supported instruction have been associated with higher levels of engagement and academic satisfaction (Bond et al., 2021). Conversely, other studies suggest that poorly designed digital environments may contribute to reduced motivation, digital fatigue, social isolation, and cognitive overload (Besser et al., 2022; Dhawan, 2020). Such inconsistencies indicate that the impact of digital learning environments on motivation may not be entirely direct but may instead operate through intermediate psychological and behavioral factors.

One potential mechanism explaining this relationship is Information and Communication Technology (ICT) engagement. ICT engagement refers to the degree to which learners actively interact with and utilize digital technologies for educational purposes, encompassing behavioral participation, technological confidence, and meaningful use of digital tools (Fraillon et al., 2020). Students who are highly engaged with ICT are generally more capable of navigating digital platforms, participating in online discussions, accessing learning resources, and maintaining productive learning habits

(Hatlevik et al., 2018). Consequently, ICT engagement may function as a mediating variable linking digital learning environments to motivational outcomes.

Despite increasing scholarly attention to digital education, relatively limited research has systematically examined the mediating role of ICT engagement in explaining how digital learning environments influence student motivation. Much of the existing literature focuses either on technological adoption or motivational outcomes independently, leaving insufficient understanding of the interaction between environmental and behavioral dimensions of digital learning (Bond et al., 2021). Addressing this gap is important for both theoretical and practical reasons, as identifying the pathways through which digital learning environments affect motivation can guide the design of more effective educational technologies and instructional strategies.

Accordingly, this study investigates the relationship between digital learning environments and student motivation while examining the mediating role of ICT engagement. By employing a quantitative research framework and structural equation modeling, the study seeks to provide empirical evidence concerning both the direct and indirect effects of digital learning environments on motivational development. The findings are expected to contribute to the literature on technology-enhanced learning and offer practical recommendations for educators and policymakers seeking to create digitally supportive and motivational learning environments.

Related Works

2.1 Digital Learning Environments and Educational Transformation

Digital learning environments (DLEs) have emerged as a central component of modern education, fundamentally transforming instructional delivery and student learning experiences. DLEs typically encompass online learning platforms, virtual classrooms, multimedia resources, learning management systems, and communication technologies that facilitate flexible and interactive learning (Castro, 2019). The rapid digitalization of education, particularly accelerated by the COVID-19 pandemic, has intensified scholarly interest in understanding the effectiveness of digitally mediated learning environments (Bond et al., 2021; Dhawan, 2020).

Previous studies have highlighted several advantages associated with digital learning environments. These include improved accessibility to educational resources, greater flexibility in learning schedules, personalized instructional pathways, and enhanced opportunities for collaborative learning (Martin et al., 2020). Digital platforms allow students to access instructional materials independent of geographical and temporal limitations, supporting learner autonomy and self-directed learning. Furthermore, multimedia and interactive technologies have been shown to facilitate deeper cognitive engagement and improve information retention (Bond et al., 2021).

However, research also suggests that the effectiveness of digital learning environments depends heavily on instructional design and technological support. Poorly structured online environments may generate cognitive overload, communication barriers, and reduced learner satisfaction (Besser et al., 2022). Consequently, scholars increasingly emphasize that the educational value of digital learning environments cannot be evaluated solely by technological availability but must be understood through learners' experiences and interactions within these environments.

2.2 Student Motivation in Technology-Supported Learning

Student motivation has long been regarded as a key predictor of academic performance and learning persistence. From the perspective of Self-Determination Theory, learning motivation is influenced by the fulfillment of psychological needs related to autonomy, competence, and relatedness (Ryan & Deci, 2020). Similarly, Expectancy-Value Theory proposes that students' engagement and performance depend on their beliefs about success and the perceived value of learning tasks (Eccles & Wigfield, 2020).

Within technology-supported learning contexts, motivation assumes particular importance due to the increased demands for self-regulation and independent learning. Several studies report that digital learning technologies can positively influence motivation by offering immediate feedback, personalized learning experiences, and interactive learning opportunities (Martin et al., 2020). Gamified learning systems, adaptive learning platforms, and collaborative online tools have been associated with increased learner engagement and positive academic attitudes (Bond et al., 2021).

Nevertheless, contradictory findings also exist. Some studies indicate that online learning environments may contribute to emotional exhaustion, reduced social interaction, and motivational decline when students experience technological difficulties or limited instructional support (Besser et al., 2022). These mixed findings suggest that motivation in digital learning environments is influenced by multiple mediating and contextual factors rather than by technology alone.

2.3 ICT Engagement as a Mediating Mechanism

ICT engagement has gained increasing attention as an important construct explaining how digital learning experiences influence educational outcomes. ICT engagement generally refers to learners' active participation, confidence, and meaningful interaction with digital technologies during learning activities (Fraillon et al., 2020). Unlike simple technological access or usage frequency, ICT engagement emphasizes purposeful and sustained involvement with educational technologies.

Empirical studies have demonstrated that students with higher levels of ICT engagement tend to exhibit stronger digital competence, improved self-efficacy, and more effective learning strategies (Hatlevik et al., 2018). ICT-engaged learners are generally more capable of navigating online platforms, managing digital information, and participating

actively in virtual learning communities. Such behaviors contribute to enhanced learning satisfaction and academic achievement.

Recent research further suggests that ICT engagement may operate as a mediating factor linking technological environments and learning outcomes. For example, digital platforms alone may not automatically increase student motivation unless learners actively engage with the available technologies and perceive them as meaningful and supportive for learning (Zhao et al., 2021). Consequently, ICT engagement may explain why similar digital environments produce different motivational outcomes across learners.

2.4 Research Gap and Conceptual Framework

Although existing literature has generated valuable insights into digital learning environments, student motivation, and ICT use, several limitations remain. First, many studies investigate technological adoption or motivation independently, without adequately examining their interaction mechanisms (Bond et al., 2021). Second, prior research often conceptualizes ICT use merely as technological access or frequency of use, overlooking the behavioral and psychological dimensions captured by ICT engagement (Fraillon et al., 2020). Third, empirical evidence examining ICT engagement as a mediating variable between digital learning environments and student motivation remains relatively limited.

To address these gaps, the present study proposes a conceptual framework in which digital learning environments serve as the independent variable, student motivation represents the dependent variable, and ICT engagement functions as the mediating mechanism. By empirically testing these relationships through structural equation modeling, the study seeks to extend current understanding of technology-enhanced learning and clarify the pathways through which digital learning environments influence motivational outcomes.

Research Methodology

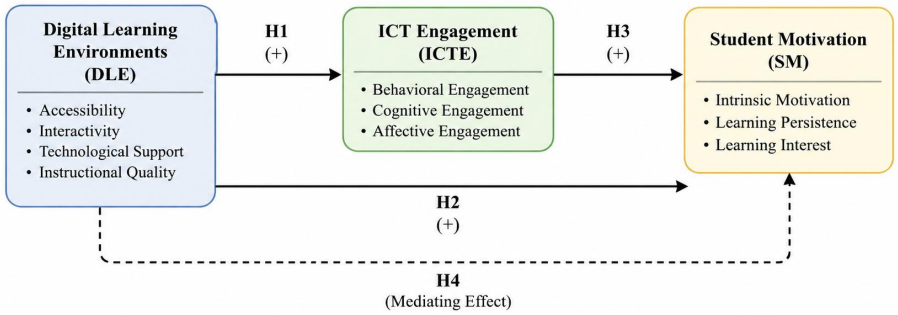
3.1 Research Design

This study adopted a quantitative research design to investigate the relationship between digital learning environments and student motivation, with particular emphasis on the mediating role of ICT engagement. Quantitative approaches are widely used in educational technology research because they allow researchers to examine causal relationships among variables and validate theoretical models using statistical techniques (Creswell & Creswell, 2018).

A cross-sectional survey design was employed to collect empirical data from higher education students who regularly participated in digitally mediated learning environments. The research framework positioned digital learning environments as the independent variable, student motivation as the dependent variable, and ICT engagement

as the mediating variable. Structural Equation Modeling (SEM) was selected as the primary analytical method due to its capacity to simultaneously evaluate measurement validity and structural relationships among latent constructs (Hair et al., 2022).
The proposed conceptual framework is illustrated in Figure 1.

Figure 1. Proposed Research Model



Note. H1–H3 represent direct effects. H4 represents the indirect (mediating) effect of ICT engagement in the relationship between digital learning environments and student motivation.

3.2 Participants and Data Collection

Participants were recruited from universities implementing digital or blended learning models. A purposive sampling strategy was employed to ensure that respondents possessed sufficient experience with digital learning platforms and ICT-supported educational activities.

Data were collected using an online questionnaire distributed through institutional communication channels and learning management systems. Participation was voluntary, and respondents were informed about the anonymity and confidentiality of their responses prior to completing the survey. A total of 420 questionnaires were distributed. After screening for missing values and invalid responses, 386 valid questionnaires were retained for final analysis, yielding a response rate of 91.9%.

Table 1 . Demographic Characteristics of Participants

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	181	46.9
	Female	205	53.1
Age	18–20	124	32.1
	21–23	188	48.7
	>23	74	19.2
Academic Level	Undergraduate	295	76.4
	Postgraduate	91	23.6

Learning Mode	Fully Online	146	37.8
	Blended Learning	240	62.2

The demographic profile indicates that the sample consisted primarily of undergraduate students and blended-learning participants, providing a relevant context for examining digital learning experiences and ICT-related engagement.

3.3 Measurement Instruments

The questionnaire consisted of three major constructs adapted from validated studies in educational technology and motivational research. All items were measured using a five-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree").

Digital Learning Environment (DLE) was measured through students' perceptions of accessibility, interactivity, technological support, and instructional quality within digital learning settings. ICT Engagement (ICTE) assessed learners' active participation, confidence, and frequency of meaningful interaction with educational technologies. Student Motivation (SM) measured students' interest, persistence, and willingness to participate in learning activities.

Table 2. Measurement Constructs and Sample Items

Construct	Code	Number of Items	Sample Measurement Item	Source
Digital Learning Environment	DLE	5	"The digital learning platform supports effective learning."	Castro (2019)
ICT Engagement	ICTE	5	"I actively use ICT tools to support my learning activities."	Fraillon et al. (2020)
Student Motivation	SM	5	"I feel motivated to complete learning tasks in digital environments."	Ryan & Deci (2020)

The measurement instruments were reviewed by educational technology specialists to ensure content validity and linguistic clarity prior to large-scale distribution.

3.4 Data Analysis Procedures

Data analysis was conducted using SPSS and AMOS/SmartPLS. The analytical procedure involved four stages. First, descriptive statistics were computed to summarize

participant characteristics and variable distributions. Second, reliability analysis using Cronbach's alpha and Composite Reliability (CR) was performed to assess internal consistency. Third, Confirmatory Factor Analysis (CFA) was conducted to establish convergent and discriminant validity. Finally, Structural Equation Modeling (SEM) was applied to examine the hypothesized relationships and mediating effects. Bootstrapping procedures with 5,000 resamples were employed to test the significance of mediation effects.

The present study develops a conceptual model to explain the relationship between digital learning environments and student motivation through the mediating role of ICT engagement. The model is grounded in technology-enhanced learning theory and motivational psychology, which collectively suggest that learning environments influence educational outcomes not only directly but also indirectly through learners' behaviors and interactions with technology.

Digital learning environments are increasingly recognized as influential educational settings that shape students' experiences, participation, and academic attitudes. Prior research indicates that digitally enriched learning systems provide flexibility, multimedia interaction, and personalized instructional opportunities, all of which may foster stronger engagement and more positive learning perceptions (Bond et al., 2021; Martin et al., 2020). Students who perceive digital learning environments as supportive and user-friendly are more likely to interact actively with educational technologies and develop favorable attitudes toward learning tasks. Consequently, digital learning environments may function as a motivational resource that stimulates greater academic involvement.

At the same time, students' experiences in digital learning environments are often dependent upon their level of ICT engagement. ICT engagement reflects the extent to which learners actively participate in technology-supported learning, utilize digital resources meaningfully, and maintain confidence in navigating technological systems (Fraillon et al., 2020). Merely providing technological infrastructure does not automatically generate positive educational outcomes. Instead, effective learning requires students to interact with and engage in digitally mediated learning processes. Learners with higher ICT engagement tend to demonstrate stronger self-regulation, digital competence, and learning persistence, which are closely associated with academic motivation (Hatlevik et al., 2018).

Theoretically, Self-Determination Theory suggests that learning motivation develops when educational settings support autonomy, competence, and relatedness (Ryan & Deci, 2020). Digital learning environments may satisfy these psychological needs by allowing flexible learning pathways and interactive learning experiences. However, such benefits are unlikely to emerge unless learners actively engage with ICT tools and digital resources. Therefore, ICT engagement may act as an important psychological and behavioral mechanism linking environmental characteristics with motivational outcomes. Based on these theoretical arguments and empirical findings, this study proposes that digital learning environments positively influence ICT engagement, which subsequently

enhances student motivation. Furthermore, digital learning environments may also exert a direct influence on motivation independent of ICT engagement.

Results and Analysis

4.1 Descriptive Statistics and Correlation Analysis

Descriptive statistical analysis was first conducted to examine the distributional characteristics of the study variables and to provide an initial understanding of their relationships. Table 4 presents the mean values, standard deviations, and Pearson correlation coefficients among digital learning environment (DLE), ICT engagement (ICTE), and student motivation (SM). The results indicate that students generally reported positive perceptions of digital learning environments ($M = 3.87$, $SD = 0.69$), suggesting relatively favorable experiences with online and technology-supported

learning systems. ICT engagement also demonstrated a moderately high mean score ($M = 3.79$, $SD = 0.73$), reflecting students' active interaction with educational technologies. Student motivation exhibited the highest average score ($M = 3.94$, $SD = 0.65$), implying that respondents maintained relatively strong motivation within digitally supported learning contexts.

Correlation analysis revealed statistically significant positive relationships among all variables. Digital learning environments showed a strong positive correlation with ICT engagement ($r = .62$, $p < .001$) and student motivation ($r = .55$, $p < .001$). Furthermore, ICT engagement was positively associated with student motivation ($r = .67$, $p < .001$). These findings provide preliminary evidence supporting the proposed theoretical model and suggest that ICT engagement may play an important mediating role linking digital learning environments to motivational outcomes.

Table 4. Descriptive Statistics and Correlation Matrix

Variable	Mean	SD	1	2	3
1. Digital Learning Environment	3.87	0.69	1		
2. ICT Engagement	3.79	0.73	0.62	1	
3. Student Motivation	3.94	0.65	0.55	0.321	1

The positive correlations observed among the variables indicate that students who experience supportive and interactive digital learning environments tend to engage more actively with ICT tools and demonstrate higher levels of learning motivation. However, correlation analysis alone does not establish causal pathways; therefore, further analyses were conducted to examine the reliability and validity of the measurement model and to test the hypothesized structural relationships.

4.2 Reliability and Validity Analysis

Before evaluating the structural model, reliability and validity analyses were performed to confirm the adequacy of the measurement instruments. Internal consistency was assessed using Cronbach's alpha and Composite Reliability (CR), while convergent validity was examined through factor loadings and Average Variance Extracted (AVE). As shown in Table 5, all constructs demonstrated satisfactory reliability. Cronbach's alpha values ranged from 0.86 to 0.91, exceeding the recommended threshold of 0.70

(Hair et al., 2022). Composite Reliability values similarly ranged from 0.88 to 0.92, confirming strong internal consistency across measurement items.

Convergent validity was also established. Standardized factor loadings exceeded 0.70 for all measurement items, indicating strong relationships between observed indicators and their corresponding latent constructs. Moreover, AVE values ranged between 0.59 and 0.71, surpassing the recommended minimum value of 0.50 and confirming adequate convergent validity. Following validation of the measurement model, Structural Equation Modeling (SEM) was employed to test the hypothesized relationships among digital learning environments, ICT engagement, and student motivation. Model fit indices indicated satisfactory overall model fit ($\chi^2/df = 2.31$, CFI = .94, TLI = .93, RMSEA = .058), suggesting that the proposed model adequately represented the empirical data.

The structural model results revealed that digital learning environments exerted a significant positive effect on ICT engagement ($\beta = .61$, $p < .001$), supporting the assumption that well-designed digital learning systems encourage students' technological participation and involvement. Digital learning environments also demonstrated a significant direct influence on student motivation ($\beta = .29$, $p < .01$), indicating that supportive digital learning conditions can independently foster motivational outcomes.

Furthermore, ICT engagement exhibited the strongest positive effect on student motivation ($\beta = .53$, $p < .001$). This result suggests that students' meaningful and sustained interaction with ICT tools substantially contributes to their learning motivation. The findings therefore highlight the importance of learner engagement as a behavioral mechanism connecting technological environments to educational outcomes.

Conclusion

This study investigated the relationship between digital learning environments and student motivation, with particular emphasis on the mediating role of ICT engagement. Drawing upon theories of technology-enhanced learning and motivational psychology, the research developed and empirically tested a structural model explaining how students' experiences within digital learning environments contribute to motivational outcomes through behavioral and technological engagement. By employing a quantitative research design and structural equation modeling, the study provides empirical evidence regarding both the direct and indirect mechanisms underlying digitally mediated learning.

The findings demonstrate that digital learning environments exert a significant positive influence on student motivation. Students who perceive digital learning systems as accessible, interactive, and supportive tend to report stronger motivation toward learning activities. These findings reinforce previous research emphasizing that well-designed digital learning environments can foster positive educational experiences and encourage sustained participation in learning processes. The results further suggest that digital learning environments should not merely be viewed as technological infrastructures but rather as pedagogical ecosystems capable of shaping learners' psychological and academic development.

More importantly, the study confirms the significant mediating role of ICT engagement. ICT engagement emerged as a key behavioral mechanism explaining how digital learning environments translate into motivational outcomes. Students who actively interacted with digital tools, participated in online learning activities, and demonstrated confidence in utilizing ICT resources exhibited higher levels of learning motivation. This finding suggests that technological availability alone is insufficient to generate motivational benefits. Instead, meaningful participation and engagement with ICT are necessary conditions through which digital learning environments can effectively support learning motivation.

From a theoretical perspective, the findings contribute to the literature on educational technology and student motivation by integrating environmental and behavioral dimensions within a unified analytical framework. While previous studies frequently examined digital learning environments or student motivation independently, the present study clarifies the pathways connecting these constructs and demonstrates the explanatory value of ICT engagement as an intermediary mechanism. The results are also consistent with Self-Determination Theory, suggesting that digitally supported learning environments may promote motivation when they facilitate autonomy, competence, and active participation.

The study also offers several practical implications. For educators and instructional designers, the findings highlight the importance of creating digital learning environments that encourage active ICT participation rather than passive technological exposure. Learning management systems, virtual classrooms, and educational platforms should therefore be designed to support interaction, collaboration, and learner autonomy. Educational institutions and policymakers should further invest not only in technological

infrastructure but also in digital literacy training and ICT-supportive pedagogical strategies that strengthen students' confidence and engagement with technology.

Despite these contributions, several limitations should be acknowledged. First, the study employed a cross-sectional design, limiting the ability to establish long-term causal relationships among the variables. Future research may adopt longitudinal approaches to examine how ICT engagement and motivation evolve over time. Second, the sample was drawn primarily from higher education contexts, which may limit the generalizability of the findings to other educational settings such as primary or secondary education. Third, the study relied on self-reported survey data, which may be influenced by social desirability or response bias.

Future research may extend the present framework by examining additional mediating or moderating variables, including digital competence, self-efficacy, teacher support, and cultural differences in technology adoption. Comparative studies across educational

levels and international contexts may further enhance understanding of how digital learning environments shape motivational development in diverse learning settings.

In conclusion, this study demonstrates that digital learning environments positively influence student motivation and that ICT engagement serves as an important mediating mechanism in this relationship. The findings underscore the necessity of moving beyond technology provision toward fostering meaningful ICT participation and learner engagement. As digital education continues to evolve, understanding the behavioral processes through which technology influences learning will remain essential for developing effective, inclusive, and motivational educational environments.

References :

Besser, A., Flett, G. L., & Zeigler-Hill, V. (2022). Adaptability to a sudden transition to online learning during the COVID-19 pandemic: Understanding the challenges for students. *Scholarship of Teaching and Learning in Psychology, 8*(2), 85–105. https://doi.org/10.1037/stl0000198

Bond, M., Bedenlier, S., Marín, V. I., & Händel, M. (2021). Emergency remote teaching in higher education: Mapping the first global online semester. *International Journal of Educational Technology in Higher Education, 18*(1), 1–24. https://doi.org/10.1186/s41239-021-00282-x

Castro, R. (2019). Blended learning in higher education: Trends and capabilities. *Education and Information Technologies, 24*(4), 2523–2546. https://doi.org/10.1007/s10639-019-09886-3

Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). Sage.

Dhawan, S. (2020). Online learning: A panacea in the time of COVID-19 crisis. *Journal of Educational Technology Systems, 49*(1), 5–22. https://doi.org/10.1177/0047239520934018

Eccles, J. S., & Wigfield, A. (2020). From expectancy-value theory to situated expectancy-value theory: A developmental, social cognitive, and sociocultural perspective on motivation. *Contemporary Educational Psychology, 61*, 101859. https://doi.org/10.1016/j.cedpsych.2020.101859

Fraillon, J., Ainley, J., Schulz, W., Duckworth, D., & Friedman, T. (2020). *Preparing for life in a digital world: IEA international computer and information literacy study 2018 international report*. Springer. https://doi.org/10.1007/978-3-030-38781-5

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2022). *A primer on partial least squares structural equation modeling (PLS-SEM)* (3rd ed.). Sage.

Hatlevik, O. E., Guðmundsdóttir, G. B., & Loi, M. (2018). Digital diversity among upper secondary students: A multilevel analysis of the relationship between cultural capital, self-efficacy, strategic use of information and digital competence. *Computers & Education, 81*, 345–353. https://doi.org/10.1016/j.compedu.2014.10.019

Hodges, C., Moore, S., Lockee, B., Trust, T., & Bond, A. (2020). The difference between emergency remote teaching and online learning. *Educause Review, 27*, 1–12.

Martin, F., Sun, T., & Westine, C. D. (2020). A systematic review of research on online teaching and learning from 2009 to 2018. *Computers & Education, 159*, 104009. https://doi.org/10.1016/j.compedu.2020.104009

Ryan, R. M., & Deci, E. L. (2020). Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions. *Contemporary Educational Psychology, 61*, 101860. https://doi.org/10.1016/j.cedpsych.2020.101860

Schunk, D. H., & DiBenedetto, M. K. (2020). Motivation and social cognitive theory. *Contemporary Educational Psychology, 60*, 101832. https://doi.org/10.1016/j.cedpsych.2019.101832

Zhao, Y., Sullivan, H., & Mellenius, I. (2021). Digital learning engagement and student motivation in technology-supported environments. *Computers in Human Behavior, 120*, 106754. https://doi.org/10.1016/j.chb.2021.106754