



Navigating learning disruptions: The role of digital learning platforms in student motivation, feedback and emotion

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ARTICLE INFO

Keywords:

Effective learning
Digital learning platforms
Crisis-driven remote education
Student motivation
Feedback
Emotion

ABSTRACT

Crises such as pandemics disrupt the motivational, feedback, and emotional processes that sustain effective learning. Digital learning platforms (DLPs) are often positioned as tools to maintain educational continuity, yet their associations with effective learning in disrupted contexts remains insufficiently understood. This study examines whether DLP use moderates the relationships between low motivation, insufficient feedback, negative emotions, and students' effective learning during crisis-driven remote education. Using a mixed-methods design, quantitative data from 216 UK university students were analysed using partial least squares structural equation modelling (PLS-SEM), and qualitative insights derived from open-ended questionnaire responses were analysed using thematic analysis. Findings indicate that diminished motivation, inadequate feedback, and negative emotions are negatively associated with learning effectiveness during crises. While DLP use was positively associated with effective learning, it did not significantly moderate the relationships between low motivation, insufficient feedback, negative emotions, and students' effective learning. Qualitative insights suggest that more favourable learner experiences occur when technological affordances are aligned with instructional design, instructor presence and emotional support. The study points to the value of incorporating motivation-enhancing strategies, personalised feedback and affective support within digital learning environments. It contributes to digital pedagogy by highlighting that DLPs relate more strongly to effective learning when their features are integrated with coherent pedagogical design, meaningful social interaction and emotionally supportive practices. These insights extend beyond crisis contexts and offer guidance for designing resilient, inclusive, and human-centred digital learning systems.

1. Introduction

Learning through digital learning platforms (DLPs) has experienced significant growth in higher education, particularly during recent crises that disrupted in-person teaching and learning (Sitar-Tăut et al., 2024; Kapo et al., 2024). DLPs are computer-assisted systems that support the design, delivery, management, and assessment of learning by enabling synchronous and asynchronous communication, content access, and learner tracking (Al-Fraihat et al., 2020; Bhuasiri et al., 2012). While in-person instruction has

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<https://doi.org/10.1016/j.compedu.2025.105534>

Received 4 December 2024; Received in revised form 7 December 2025; Accepted 10 December 2025

Available online 12 December 2025

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regained prominence as conditions improved, the pedagogical advantages of DLPs, such as enhanced accessibility, flexibility, collaboration, and learner autonomy, continue to enrich higher education (Dziuban et al., 2018; Rawas, 2024). Computers, as the core technological infrastructure of DLPs, have transformed educational pedagogy by enabling more personalised, collaborative, and adaptive forms of instruction (Väätäjä & Ruokamo, 2021; Tan et al., 2024). This ongoing digital transformation has positioned DLPs as a central component of modern higher education, promoting more inclusive, engaging, and adaptable learning environments (Mexhuani, 2025).

Despite these pedagogical advantages, the perceived role of DLPs in supporting effective learning during crises remains contested. In this study, a crisis refers to a sudden and substantial disruption that interrupts the normal functioning of educational institutions, creating challenges for teaching, learning, and student support (Chatzipanagiotou & Katsarou, 2023; Grissom & Condon, 2021). Such disruptions, whether caused by pandemics, political instability, or natural disasters, reshape educational routines and relationships, destabilising the mechanisms that sustain effective learning. However, empirical evidence remains limited on how DLPs help address these disruptions and relate to learning continuity, highlighting the need for further investigation into their role during crises. Existing research has largely outlined the challenges faced by higher education during such disruptions and proposed online learning as a potential solution (Abdelfattah et al., 2023; Maatuk et al., 2022). Yet few studies have examined how DLPs specifically address the learning barriers that emerge under crisis conditions, and existing findings on their contribution to effective learning remain inconsistent (Decuyper et al., 2021; Wu, 2024).

This highlights the importance of examining how the specific advantages of DLPs can help address the challenges that emerge when educational continuity is disrupted. Building on established models of effective learning (Ambrose et al., 2010), this study focuses on three dimensions that are particularly vulnerable during crises: motivation, feedback, and emotion. These dimensions are essential for sustaining students' engagement, direction, and psychological balance in learning, yet they rely heavily on consistent interaction and communication. During crises such as the pandemic, these connections were severely strained. Disrupted educational routines generated uncertainty and emotional fatigue that undermined motivation and participation (Clabaugh et al., 2021; Marler et al., 2024), while social isolation heightened stress and anxiety. Simultaneously, the shift to online delivery altered feedback processes, making them slower, less personal, and harder to interpret (Uribe & Vaughan, 2017). As a result, motivation waned, emotions intensified, and feedback lost its formative function, weakening the core mechanisms that sustain effective learning. Understanding these three dimensions in a crisis context is therefore essential for explaining how students adapt and how DLPs may support the disrupted dynamics of engagement and learning.

Students' motivation is crucial for achieving educational goals, especially in online learning (Castillo-Merino & Serradell-López, 2014; Yang, 2024). It is described as the 'engine of learning' (Paris & Turner, 1994) and essential for fostering success (Das et al., 2025). Highly motivated learners engage more actively, gain deeper knowledge, and better utilise digital learning resources (Kapo et al., 2024). Research highlights that crises, by causing social isolation, can harm students' motivation (Marler et al., 2024; Mendoza et al., 2023). DLPs, when designed to reinforce learners' sense of capability and task engagement, are proposed to support motivational processes during disruption (Mendoza et al., 2023).

Feedback is a critical yet challenging aspect of teaching and learning (Cáceres et al., 2021; Jensen et al., 2021). During crises, limited communication channels make providing effective feedback harder, negatively impacting students' learning (Uribe & Vaughan, 2017). Flores et al. (2024) found that the emergency shift to online teaching increased student concerns about feedback quality. In digital learning, feedback is vital for helping students manage their learning, and studies indicate that online feedback can lead to more favourable learning outcomes (Biresaw & Bogale, 2024). With reduced in-person interaction during crises, feedback becomes both a cognitive and affective bridge, linking learners, instructors, and peers (Jensen et al., 2021).

Finally, emotion plays a fundamental role in sustaining attention, regulating effort, and maintaining engagement. Emotionally adverse environments, marked by anxiety, frustration, boredom, or isolation, are associated with lower learning outcomes (Hernández-Sellés et al., 2019). Crises amplify these negative emotions by reducing social presence and interaction (Barrot et al., 2021; Huang et al., 2025). Shao et al. (2024) confirmed that students experienced heightened emotional strain during the pandemic, which impaired concentration and persistence. By fostering interaction, instructor presence, and a sense of community, DLPs may help reduce frustration and boredom, thereby stabilising learners' emotional states and supporting stronger engagement.

Accordingly, a conceptual model is proposed suggesting that waning motivation, inadequate feedback, and negative emotions are negatively associated with effective learning (Hensley et al., 2022; Hollister, 2022; Pfefferbaum & North, 2020). Furthermore, drawing on established frameworks from educational psychology and online pedagogy, the use of DLPs is proposed to moderate these relationships, as their affordances, such as enhanced interaction, timely feedback, and social presence, are theorised to weaken the adverse associations of waning motivation, inadequate feedback, and negative emotions with learning effectiveness during disruption (Capone & Lepore, 2022; Collazos et al., 2021; Garrison et al., 2000; Maier & Klotz, 2022; Ryan & Deci, 2000).

While previous studies recognised these three challenges as central (Conrad et al., 2022; Pelikan, Lüftenegger, & Holzer, 2021), they often focused on a single factor or overlooked how motivation, feedback, and emotion collectively shape learning outcomes. In other words, although the benefits of DLPs for learning are acknowledged, their role in supporting students during periods of disruption remains underexplored. Developing a holistic understanding of these challenges and how DLPs respond to them offers valuable contributions. Building on this gap, this study examines the extent to which DLP use moderates challenges arising when online interaction becomes the primary mode of education during crises. Accordingly, the primary question this study aims to answer is: *"To what extent does the use of digital learning platforms moderate the relationships between low motivation, inadequate feedback, and negative emotions and students' effective learning during crises?"*

To address this question, our study draws on both qualitative and quantitative data from a sample of 216 students at a UK university that adopted emergency teaching arrangements during the pandemic. This period significantly reshaped UK higher education, creating

both opportunities and pressures for the sector (Burns et al., 2020). This transformation makes the UK context ideal for exploring how DLPs operate under crisis conditions.

Our findings add to ongoing discussions in the literature by highlighting the dual role of DLPs in education during crises. Our results show that DLP use is positively associated with effective learning, reflecting students' views that these platforms help sustain continuity by offering accessible, flexible and scalable tools. However, the study also reveals limitations in the extent to which DLPs address key challenges such as low motivation, inadequate feedback and negative emotions. We found that DLP use did not significantly moderate the associations of waning motivation, inadequate feedback and negative emotions with learning effectiveness. The qualitative findings further indicate that students perceived DLPs as more beneficial when supportive elements, such as motivation-enhancing strategies, personalised feedback and emotional support, were integrated within online learning environments. Although these findings originate from a pandemic setting, they remain relevant to digital learning more broadly, as DLPs have increasingly become central to higher education globally. With the ongoing shift toward virtual and hybrid learning, these insights help clarify the conditions under which DLPs are perceived as contributing to a more inclusive and effective learning experience.

2. Theoretical background and hypotheses development

Effective learning is the process by which students internalise and apply the knowledge and skills targeted in instruction (Hiltz et al., 2000). Rooted in educational theory and practice, Ambrose et al. (2010) outline seven core principles: (i) activation of prior knowledge, (ii) organisation of newly acquired knowledge, (iii) mastery of application, (iv) receipt of constructive feedback (Biggs et al., 2022; Brookhart, 2017), (v) development as self-directed learners (Brockett & Hiemstra, 2018), (vi) sustained motivation (Ryan & Deci, 2000; Schunk & Usher, 2012), and (vii) cultivation of an intellectually stimulating, socially engaging, and emotionally supportive climate. As effective learning depends on interaction and communication (Schunk & Usher, 2012), crisis conditions are likely to unsettle these dynamics. Motivation, feedback, and emotion, three particularly fragile dimensions, tend to be the most vulnerable when uncertainty and social disconnection weaken the relational exchanges that sustain engagement and the cognitive focus required for effective learning.

Crises such as pandemics, political unrest, or natural disasters destabilise learning environments by eroding the psychological safety and social connectedness that sustain relational and cognitive engagement. The Behavioural Immune System (BIS) theory (Terrizzi Jr et al., 2013) explains how perceived threats activate precautionary psychological defences - heightened vigilance, risk aversion, and social withdrawal - that function to minimise exposure to danger. In everyday life, these responses encourage protective distancing; in educational settings, they constrain the interpersonal and cognitive openness that effective learning requires (Ackerman et al., 2009). When students perceive the environment as uncertain or threatening, attention narrows, exploratory behaviour declines, and social exchange is experienced as risky rather than rewarding (Carlson, 2020). The result is a contraction of the relational space through which motivation, feedback, and positive emotion are sustained.

These BIS-driven protective mechanisms, adaptive in evolutionary terms, became pedagogically visible during the pandemic lockdowns. In higher education, the abrupt transition to emergency online teaching forced students and instructors to adapt to digital environments with limited preparation or institutional support. This sudden shift disrupted established patterns of motivation, feedback, and emotional engagement: goals and expectations became unclear, opportunities for timely interaction and guidance diminished, and heightened uncertainty intensified negative emotions such as anxiety and frustration. The abrupt closure of campuses and prolonged social isolation dismantled the everyday scaffolding of learning: informal conversations, peer collaboration, and face-to-face feedback (Hollister et al., 2022; Regmi & Jones, 2020). Deprived of these supports, students were forced to rely on heightened self-regulation and motivation to sustain engagement (Ryan & Deci, 2000), yet these capacities were undermined by pervasive uncertainty and chronic stress. As vigilance and anxiety consumed cognitive resources, concentration, planning, and persistence waned. At the same time, confinement and isolation eroded the emotional resilience needed to manage frustration and maintain a sense of progress (Pfefferbaum & North, 2020). Together, these interlocking pressures depleted motivation, weakened feedback processes, and destabilised emotion, explaining why these three dimensions proved most fragile during the crisis. Informal discussions with students early in the project echoed these patterns: many described declining motivation, limited feedback, and heightened emotional strain as the most pressing challenges to their learning.

In the wake of these disruptions, higher education institutions turned to digital technologies to stabilise learning (Lacka et al., 2021). Empirical studies show that course management systems and related tools enhance learning (Hood et al., 2015; Valdez et al., 2022), with research on adoption factors (Khechine et al., 2020) and outcomes highlighting technology's positive effects on collaboration, interaction, and engagement (Cantabella et al., 2018; Wu, 2024). Yet this literature largely addresses what technology achieves rather than how or how effectively DLPs reconstruct the disrupted dynamics of motivation, feedback, and emotion that effective learning requires.

When thoughtfully designed, DLPs can help rebuild the learning conditions disrupted during crises by supporting three key dimensions of effective learning: motivation, feedback, and emotion. Synchronous and asynchronous tools reopen opportunities for dialogue and collaboration, transforming isolation into shared participation and belonging. Integrated feedback mechanisms clarify goals, reduce uncertainty, and signal progress, while visible instructor presence and peer interaction foster inclusion and psychological safety that alleviate negative emotions such as anxiety and frustration. Collectively, these affordances reflect the Community of Inquiry (CoI) framework (Garrison et al., 2000), which emphasises the interplay of teaching, social, and cognitive presence in meaningful online learning and illustrates how DLPs can restore the communicative and affective foundations of learning weakened under crisis conditions. However, empirical evidence remains limited on the extent to which these platforms address the motivational, feedback, and emotional disruptions intensified by crisis contexts. To address this gap, the present study examines the proposed role of DLPs as

mechanisms of pedagogical support and tests whether their use moderates crisis-induced vulnerabilities in motivation, feedback, and emotion.

Building on this foundation, the following sections examine in greater depth how crises compromise the principles of motivation, feedback, and emotion, and how DLPs can moderate these effects to support more resilient forms of effective learning.

2.1. *Waning motivation in learning during crises*

Motivation is defined as “the process whereby goal-directed activity is instigated and sustained” (Schunk et al., 2008, p. 4). The significance of motivation in the learning context has been widely acknowledged. Ames (1990) underscores this importance by quoting a former Secretary of Education's maxim: “there are three things to remember about education. The first is motivation. The second one is motivation. The third one is motivation”. In essence, motivation acts as the ‘engine of learning’ (Paris & Turner, 1994), propelling, guiding, and sustaining students' learning endeavours (Ambrose et al., 2010).

Drawing from established motivation theory, particularly social cognitive theory (Bandura, 1986), various motivational beliefs, such as self-efficacy, play a pivotal role in driving students' learning. Self-efficacy reflects an individual's belief in their capability to successfully perform a task. Students possessing high self-efficacy are more likely to approach learning tasks with confidence, invest greater effort (Salomon, 1984), and persevere in the face of challenges (Robbins et al., 2004). Likewise, empirical research also highlights the importance of task value as another motivational belief (e.g. Artino Jr, 2009). Task value relates to students' assessment of a course's interest, utility, and importance within their personal context (Eccles & Wigfield, 2002). Recognising task value positively influences motivation and contributes to effective learning outcomes (Ryan & Deci, 2000). This highlights how students' perception of the worth of their learning experiences fuels their engagement and persistence in the educational process.

Motivational learning theories contribute to a broader theoretical movement emphasising the influence of social values and the learning environment on the formation of learners' motivation (Boekaerts, 1999). It is important to recognise that school motivation cannot be detached from crises as a social issue and the context in which learning is embedded. In a crisis, new and unfamiliar circumstances emerge, leading to shifts in behaviour and cognition that necessitate adaptations (Lourenco & Casey, 2013). While traditional classrooms offer educators the ability to provide guidance and structure, the closure of physical campuses necessitates greater student autonomy. This underscores the importance of students taking greater responsibility for directing and managing their academic journey (Broadbent et al., 2020).

The dynamics introduced by such situations can evoke feelings of unfamiliarity and uncertainty. Consequently, the fear arising from the unknown (Sandybayev, 2020) can erode students' confidence in their learning abilities (Fofana et al., 2020), contributing to a noticeable decline in motivation. Furthermore, with the compounded burdens of anxiety and concerns about exposure to crises, coupled with the global ramifications, students may begin to question the value of their learning efforts, further dampening their motivation for study (Hensley et al., 2022). Given the interconnected relationship between motivation and effective learning during crises, we posit the following hypothesis:

H1. Waning motivation among students during crises is negatively associated with effective learning.

2.2. *Inadequate feedback from instructors during crises*

The provision of constructive feedback on students' performance has been widely acknowledged as the ‘lifeblood of learning’ (Rowntree, 1987). Learners benefit from receiving timely and frequent feedback that provides insights into their performance relative to specific target criteria or intended learning outcomes, equipping them with the necessary information to meet those criteria (Carless, 2015; Crooks, 2004). There are various methods for delivering feedback to students, which can be categorised into informal and formal approaches (Brown & Knight, 2012). Informal feedback is rooted in social interactions and observations made while working with students, while formal feedback encompasses structured appraisals, meetings, and performance reviews (London & Smither, 2002). An effective combination of both informal and formal feedback mechanisms can bridge the gap between actual knowledge and desired standards, promoting students' autonomy and self-regulation (Boor & Cornelisse, 2021). This integration of feedback contributes to enhancing learning outcomes.

The challenge posed by the lack of social interaction due to physical absence from campus during crises, however, caused students to receive far less frequent and immediate feedback from instructors compared to students in face-to-face classes (Kim et al., 2014). Despite this, the role of constructive feedback became even more crucial in supporting students' learning. Effective feedback extends beyond the teaching and learning process itself; it provides guidance, nurtures motivation (Biggs et al., 2022), and aids in building self-efficacy and self-esteem (Beatson et al., 2018; Wang & Wu, 2008). Therefore, amid the challenges posed by crises, constructive feedback has the potential to support students' adaptation to the new learning landscape and help them overcome obstacles (Wang & Wu, 2008). Paradoxically, the very element needed to help students confront the challenges posed by crises was itself in short supply. Thus, we posit the following hypothesis:

H2. Inadequate feedback to students during crises is negatively associated with effective learning.

2.3. *Negative emotions experienced during crises*

Students are not just intellectual beings; they are also social and emotional entities (Ambrose et al., 2010; Dirkx, 2006; Reeve, 2014). Emotionally, successful learners experience positive emotions like enjoyment, hope, and pride while learning (Pekrun et al.,

2010). They also learn to manage negative emotions such as boredom, anxiety, frustration, and anger (Zembylas, 2008). Emotions are 'socially constructed' although they are 'personally enacted' (Schutz et al., 2006, p. 344). This suggests that emotions should be considered in the context of how individuals interact with their environment.

Several factors related to crises, such as social isolation, anxiety, and fear, can lead to a range of negative emotions. The sudden shift to remote learning and the absence of face-to-face interactions have disconnected students from their social networks, causing feelings of detachment and isolation (Schunk et al., 2008). Without spontaneous conversations, group activities, and in-person interactions, students may experience boredom and frustration due to the lack of variety and spontaneity that social interactions provide (O'Regan, 2003). Research into effective learning from an emotional perspective has shown that such negative emotions can hinder effort, attention, interest, elaboration, and motivation (Pekrun et al., 2010), impeding learners' ability to engage effectively with course materials and the learning process (Kim & Hodges, 2012). Considering this, effective learning is expected to be adversely affected by the negative emotions triggered by crises. Thus, we posit the following hypothesis:

H3. Negative emotions precipitated by crises are negatively associated with effective learning.

2.4. The moderating role of digital learning platforms during crises

Digital learning platforms play a central role in this research, conceptualised as moderating the associations between crisis-related challenges and effective learning. Technological advancements have enabled the education landscape to respond to these obstacles, allowing students to continue their studies despite social distancing measures. While online learning predates crises, the learning environment has significantly transformed. Given the unprecedented difficulties that crises create for students, there remains a need to examine the effectiveness of DLPs in addressing these challenges.

Digital learning, powered by digital tools like Zoom, Blackboard, or other virtual learning management systems, represents a paradigm shift in distance education. It creates a digital social climate that transcends spatial and temporal constraints, enriching the learning experience (Oren et al., 2002). Communication includes email exchanges, online discussions, and live sessions, supporting both asynchronous and synchronous interactions (Katz, 2002). Synchronous communication, similar to face-to-face interactions, promotes immediate social engagement and real-time assistance (Hrastinski, 2008), while asynchronous communication offers flexibility for self-paced learning. These tools create an interconnected learning environment that accommodates diverse preferences and schedules, empowering students to participate conveniently (Oren et al., 2002). This approach nurtures engagement with course content, peer communication, and instructor-student dialogue (Swan, 2002), supporting remote learners during crises and contributing to effective learning. Furthermore, DLPs facilitate a more effective learning experience for a diverse group of learners by utilising interactive content that can be customised to meet individual needs. Accordingly, we propose the following hypothesis:

H4a. The use of digital learning platforms during crises is positively associated with effective learning.

In technology-mediated settings, continuous communication helps students feel connected to others in their learning environment and remain part of an active community. Such social interaction supports motivation by facilitating collaboration, peer assistance, and a sense of shared purpose (Haythornthwaite & Andrews, 2011). These social dynamics become particularly important during crises, when internal motivation and positivity often wane. Virtual interactions allow students to seek clarification early and receive timely encouragement, preventing challenges from escalating and helping them maintain confidence in their learning abilities. By sustaining connection and responsiveness, DLP-mediated interaction has the potential to weaken the adverse impact of waning motivation on effective learning. Consistent with the Community of Inquiry's concept of social presence, DLPs foster the belonging and immediacy needed to support engagement under crisis conditions (Garrison et al., 2000). We thus propose the following hypothesis:

H4b. The use of digital learning platforms during crises moderates the association between waning motivation and effective learning.

DLPs enable frequent interaction between educators and students (Katz, 2002), facilitating timely, personalised feedback on course content and learning approaches. Instructors can provide feedback through asynchronous or live communication. Regardless of the method, direct channels such as online discussions (Cook & Dupras, 2004) or videoconferencing (Fadde & Vu, 2014) support clarification of misunderstandings and responsiveness to student queries. These affordances have the potential to mitigate challenges associated with inadequate feedback and enhance students' learning experiences during crises. They also reflect the construct of teaching presence (Garrison et al., 2000), which emphasises clarity, structure, and responsiveness in facilitating meaningful, timely feedback. Consequently:

H4c. The use of digital learning platforms during crises moderates the association between inadequate feedback and effective learning.

Equally, when students perceive support from the online learning environment, they are more likely to develop positive emotions that help them overcome the anxiety, frustration, and boredom caused by self-isolation during crises. Instructors who offer positive reinforcement, convey optimism, acknowledge students' contributions, and help resolve uncertainties through DLPs can cultivate a sense of cohesion (Jones & Issroff, 2005). Such interactions create a stabilising emotional climate that reduces the affective disruptions that undermine students' capacity to concentrate and participate meaningfully in online learning. In this way, DLP use is expected to weaken the adverse association between negative emotions and effective learning. Consistent with the Community of Inquiry's conception of social presence, these forms of connection and responsiveness help students manage emotionally challenging conditions and maintain the emotional stability required for learning during crises (Garrison et al., 2000). In light of these insights, our formulated

hypothesis is as follows:

H4d. The use of digital learning platforms during crises moderates the association between negative emotions and effective learning.

Fig. 1 illustrates all the hypothesized relationships among effective learning, waning motivation, inadequate feedback, negative emotions, and digital learning platforms.

3. Method

3.1. Research model and procedure

This study adopts a mixed-methods approach to investigate the relationships between DLP use and students' effective learning during crises. A convergent design was utilised, employing a questionnaire to collect both quantitative and qualitative data from students at a large UK university. Before developing the questionnaire, we held a series of informal online discussions with four students to gain a clearer understanding of the learning context and the key challenges experienced during crises. Insights from these discussions informed the refinement of the questionnaire and guided the adaptation of existing measurement scales to ensure relevance to the study context. The study specifically examines how the transition to online teaching affected student motivation, feedback quality, emotional responses, and overall learning effectiveness. This approach enables measurable patterns to be explored through quantitative data, while qualitative responses provide explanatory depth. The integration of both data types through triangulation enhances confidence in the findings and offers a more complete understanding of the challenges involved in sustaining effective online learning during crises.

3.2. Research setting and sample

This study examines students' learning experiences within the UK higher education sector, which was shaped by the emergency shift to online teaching during the coronavirus pandemic. Data were collected from students studying in the Faculty of Humanities at a large UK university. The university campus was closed during the pandemic, and all teaching and learning activities were transitioned to online environments. The study specifically focused on the Faculty of Humanities, where all courses were conducted entirely online without in-person labs or alternatives, eliminating face-to-face interactions between students and instructors, as well as among students. During this period, Blackboard was the main DLP. It served not only as a repository for teaching materials but also as a central hub for interactive and support activities. These activities included live teaching sessions, seminar meetings, feedback sessions, and academic advising, all of which were carried out through the platform to maintain continuity of learning.

A non-probability sampling approach was utilised, with programmes within the Faculty of Humanities identified for inclusion. Programme administrators were asked to email the participant information sheet, which provided key information about the study,

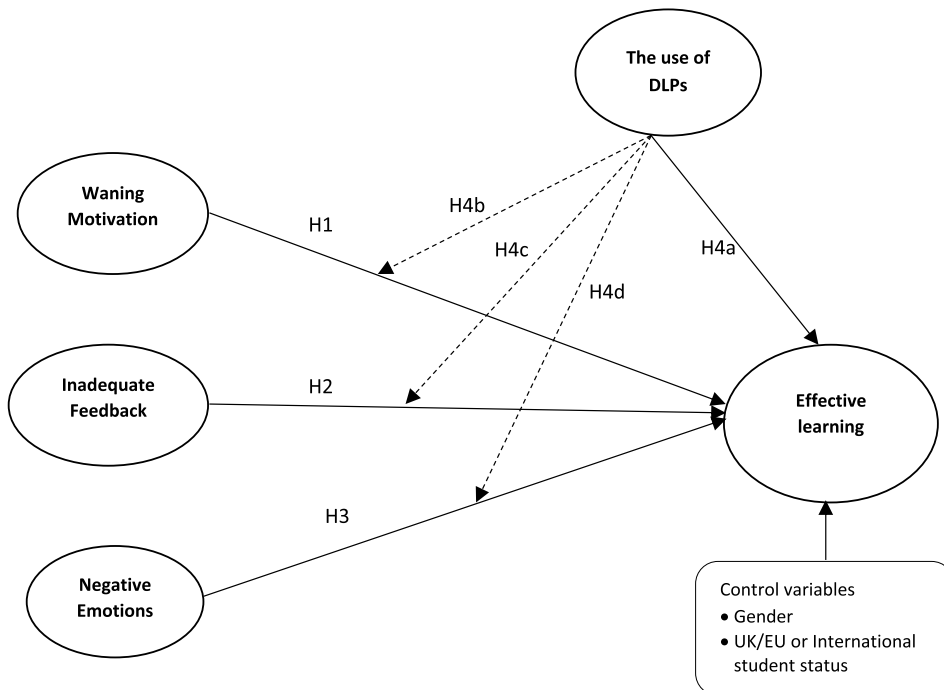


Fig. 1. Research framework.

including its purpose and its focus on understanding students' digital learning experiences, along with the link to the online questionnaire. Over the course of two months (August and September 2020), students could participate in the study by completing the online questionnaire. Programme administrators issued a reminder four weeks after the study began. A total of 362 questionnaires were collected, of which 146 were partially completed and excluded from the analysis. This led to a final sample of 216, reflecting a response rate of approximately 60 %. Scheaf et al. (2023) highlight that response rates in social science research have been declining, a challenge our study also faced, likely due to the pandemic. To evaluate potential non-response bias, we employed wave analysis by comparing early respondents ($n = 125$) with late respondents ($n = 91$), following the approach of Armstrong & Overton (1977). Participants were divided into two groups, and t-tests were conducted on key variables, including gender, study level (i.e., undergraduate, postgraduate), and the use of DLPs. The findings revealed no significant differences between early and late respondents ($p > 0.05$), indicating that non-response bias was not a concern in our data.

Participants came from a varied mix of undergraduate and postgraduate programmes, spanning a wide range of academic disciplines within the university. Their study areas included International Development, Management and Information Systems, Business and Management, Economics, Accounting and Finance, Human Resource Management, Development Economics and Policy, Politics and International Relations, Criminology, Sociology, History, Philosophy, English Literature, and Data Science, among others. This disciplinary breadth ensured that the findings reflected diverse academic perspectives and learning experiences with DLPs, rather than being confined to a specific field or mode of study. Most participants had no prior exposure to fully online learning, and their sustained engagement with DLPs began as part of the emergency transition to online education.

3.3. Instruments and validity

A survey instrument was developed using reflective measurement scales, with items for each construct taken from established and validated scales. All constructs are measured on a seven-point Likert scale ranging from "completely agree" (7) to "completely disagree" (1). To ensure the content validity of the instrument, we consulted academic experts and students to review the validity of the survey questions. Based on the feedback we received, we modified the items to ensure the questions were clear and appropriately phrased. This process helped us confirm the extent to which the measures accurately represent the intended content domain (Ozkan & Koseler, 2009). The final version of the survey includes five constructs, measured using a total of 17 items, as outlined below.

Waning Motivation refers to the degree to which students perceived that their lack of motivation hindered their learning. It was measured with three items using two dimensions adapted from Pintrich (1991) and Artino-Jr and McCoach (2008): task value (one item) assessing the perceived importance and usefulness of course materials, and self-efficacy (two items) assessing students' confidence in learning online. *Inadequate Feedback* captures students' perceptions of how limited feedback from instructors during campus closures influenced their learning. It was measured with four items adapted from Ellis et al. (2009) and Şat (2017). *Negative Emotions* was operationalised to evaluate the extent to which emotions experienced during the disruption affected students' learning. It comprises two dimensions adapted from Pekrun et al. (2005): 1. A two-item boredom dimension assessing course-related boredom following campus closures; 2. A three-item frustration dimension assessing course-related frustration, annoyance, and irritation. Boredom and frustration were selected because they were especially prominent in students' experiences during the transition to online learning. The *Use of DLPs* construct assesses the extent to which platform use supported students in managing learning-related challenges. It was measured with two items adapted from Hernandez et al. (2011) and Flogie et al. (2019). *Effective Learning* was measured using a

Table 1
Measurement items and properties

Construct Measure	Outer loadings	t-value
Waning Motivation (CR = 0.852, AVE = 0.663, Cronbach's Alpha = 0.733)		
I feel more that the course materials are not useful for me to learn.	0.603	8.758
I am NOT confident I could learn without the presence of an instructor to assist me.	0.894	41.759
I am NOT certain I could understand the most difficult material presented in an online course.	0.909	53.128
Negative emotions (CR = 0.901, AVE = 0.646, Cronbach's Alpha = 0.863)		
During the lockdown teaching, I felt the course was fairly dull.	0.824	29.207
During the lockdown teaching, I thought about what else I would rather be doing.	0.855	41.387
During the lockdown teaching, I felt frustrated.	0.723	16.236
During the lockdown teaching, I was angry.	0.833	32.714
During the lockdown teaching, I felt as though I was wasting my time.	0.776	21.58
Inadequate Feedback (CR = 0.930, AVE = 0.769, Cronbach's Alpha = 0.900)		
Teachers could NOT provide enough guidance.	0.852	34.552
Less teachers' interactivity with me discouraged me from getting the most out of my learning.	0.862	40.709
I could NOT get enough feedback which gives direction during the revision process.	0.893	53.278
I could NOT get enough feedback which provides what needs to be done to improve weak sides of performance.	0.900	59.327
The use of digital learning platforms (CR = 0.900, AVE = 0.818, Cronbach's Alpha = 0.781)		
The teachers used e-learning tools for their course support.	0.930	44.719
I spent time in using e-learning tools to participate in online sessions.	0.879	26.086
Effective Learning (CR = 0.905, AVE = 0.760, Cronbach's Alpha = 0.842)		
During the lockdown teaching, adequate resources and tools were provided to learn the subject field.	0.868	42.14
During the lockdown teaching, I was given chances to practice what I learn.	0.873	35.591
During the lockdown teaching, I was allowed to appreciate the important issues about the subject field.	0.875	34.640

three-item scale adapted from Hu and Hui (2012). Table 1 presents the measurement scales, including their reliability and validity metrics for each construct.

The study employed a mixed-methods approach using a convergent design questionnaire variant (Creswell & Plano Clark, 2018). Quantitative and qualitative data were collected simultaneously through an online survey. Given the complexity of crisis-driven learning contexts, qualitative input was essential for capturing experiences that structured scales cannot fully convey. To this end, the questionnaire included two open-ended items: (1) “What can be improved to enhance the quality of an online course?” and (2) “What additional resources can help improve your learning effectiveness in online teaching?” Their general phrasing allowed students to identify the issues they viewed as most significant, enabling unanticipated concerns to surface, which is recommended in mixed-methods research for understudied or volatile contexts (Creswell & Plano Clark, 2018). Responses were analysed inductively to generate initial codes and themes (Braun & Clarke, 2006). These themes were then mapped onto the study's theoretical constructs of motivation, feedback, and emotion by drawing on well-established links in the educational technology literature, following recommended procedures for connecting emergent qualitative insights to conceptual frameworks (Corley & Gioia, 2004). This ensured that the qualitative data both broadened and deepened understanding of the core variables.

3.4. Data analysis

We used both quantitative and qualitative data analysis methods to examine the data. For the quantitative analysis, we applied partial least squares structural equation modelling (PLS-SEM) using SmartPLS 4. PLS-SEM is considered an appropriate analytical tool for several reasons. To the best of our knowledge, this research is among the few studies to explore the impact of DLPs in addressing challenges related to crises in effective learning. Accordingly, the exploratory nature of this study made PLS-SEM suitable, as it is recommended for exploratory research and prediction-oriented models rather than theory confirmation (Hair et al., 2019). Additionally, this study proposed a complex model incorporating moderating effects between DLPs and crisis-related challenges in effective learning. Given this level of complexity, prior research has recommended PLS-SEM as a robust analytical approach (Hair et al., 2019). It has also been shown to deliver reliable results and greater robustness in cases where CB-SEM produces inadmissible outcomes or fails to converge, particularly in complex models with small sample sizes (Sarstedt et al., 2016). Taken together, these characteristics made PLS-SEM an appropriate analytical method for this study.

To examine the qualitative data, we employed thematic analysis, which provides a systematic yet flexible approach to identifying and interpreting patterns within participant responses (Braun & Clarke, 2006). The analysis proceeded in several stages. First, the data were reviewed in detail to familiarise the researchers with participants' responses. These responses were then coded inductively, with codes grouped into broader themes using NVivo 12 to support the process. For example, codes such as technical issues, inclusivity, and study environment were grouped under the theme Digital Learning Accessibility and Experience.

In a subsequent phase, these inductively derived codes and themes were linked to the constructs of motivation, feedback and emotion in light of established connections in the educational technology literature (e.g., Deci & Ryan, 2000; Hattie & Timperley, 2007; Pekrun, 2006). For instance, technical issues and inclusivity were linked to motivation; feedback-related codes (e.g., timeliness, regular touchpoints) were connected to the feedback construct; and codes such as emotional support and varied activities were associated with emotion. This process followed the iterative inductive and theoretical cycling described by Corley & Gioia (2004), ensuring that emergent student perspectives were aligned with higher-order theoretical categories while remaining grounded in the data. Table 6 (Appendix) presents exemplary student quotes corresponding to each theoretical category, theme and code.

The initial coding was conducted by the first researcher, who generated a list of codes. To enhance the trustworthiness of the analysis, the second researcher independently coded a sample of the data; any discrepancies were resolved through discussion until consensus was achieved. Regular peer debriefings and continuous comparisons of the coded data further contributed to the credibility and transparency of the findings (Nowell et al., 2017). Although we employed collaborative coding practices to enhance rigour, our broader approach remained consistent with thematic analysis (Braun & Clarke, 2006), emphasising the interpretative construction of meaning rather than seeking statistical measures of coder agreement.

Finally, the qualitative findings were integrated with the quantitative results through explanatory triangulation (Creswell & Plano Clark, 2018). In practice, this meant constructing joint displays where non-significant quantitative results (e.g., the moderation effect for motivation) were directly aligned with relevant qualitative codes (e.g., technical issues, inclusivity, study environment). This approach highlighted areas of convergence, complementarity, and divergence between the two strands of data, providing richer explanations of why DLPs did not moderate key challenges and suggesting strategies for improvement.

4. Results

4.1. Results of quantitative analysis

4.1.1. Common method variance

As with all self-reported data collected from single respondents at a single point in time, there was a potential issue of common method variance (CMV) and bias (Podsakoff & Organ, 1986). To address this, both procedural and statistical remedies were employed. First, item construction was scrutinised with input from academics to improve face validity and minimise ambiguity. Respondents were assured of anonymity and full confidentiality to reduce social desirability bias and the pressure to provide ‘correct’ answers (Chang et al., 2010).

Our statistical analyses began with Harman's one-factor test (Podsakoff et al., 2003). The unrotated principal component analysis

showed that the first factor accounted for only 41.235 % of the total variance, below the 50 % threshold, indicating no significant common method bias (Podsakoff et al., 2003). The results are detailed in Table 2a. Additionally, full-collinearity variance inflation factors (VIFs) were assessed using partial least squares structural equation modelling (PLS-SEM). VIFs of 3.57 or lower suggest no common method bias (Kock & Lynn, 2012), and the analysis confirmed that all VIFs in our model were below this threshold, ranging from 1.142 to 3.311, as detailed in Table 2b. Overall, these results indicate that common method bias is unlikely to pose a significant threat to this study.

4.1.2. Descriptive statistics

The descriptive statistics show that female students comprised the majority of the sample (70.8 %), with male students representing 29.2 %. The sample included 56 % international students and 44 % UK/EU students.

4.1.3. Assessment of measurement model

The measurement model was assessed using reflective indicators by evaluating reliability and validity. The Cronbach's alpha values for each construct were above 0.7, ranging from 0.733 to 0.900, indicating a high level of internal reliability (Fornell & Larcker, 1981). CR scores were also used to assess internal reliability of the latent variables (Werts et al., 1974). The CR scores were all above 0.8, ranging from 0.852 to 0.930, indicating that the composite measurement items have sufficient reliability (Hair et al., 2017). A minimum cut-off of 0.5 was applied for indicator outer loadings (Hair et al., 2011; Henseler et al., 2009). The standardised first-order outer loadings ranged from 0.603 to 0.930, with most items exceeding 0.7 (Fornell & Larcker, 1981).

Convergent and discriminant validity were examined to assess construct validity. All constructs showed average variance extracted (AVE) values greater than the 0.5 threshold, ranging from 0.646 to 0.818, confirming convergent validity (Fornell & Larcker, 1981). Discriminant validity was assessed using the Fornell-Larcker criterion and the Heterotrait-Monotrait (HTMT) ratio. Fornell-Larcker was satisfied where the square root of each construct's AVE was higher than its cross-loadings (Fornell & Larcker, 1981; Hair et al., 2011). As shown in Table 3, this confirms discriminant validity. HTMT ratios were also examined as an alternative method (Henseler et al., 2014). All HTMT values were below the conservative threshold of 0.85, further confirming discriminant validity.

4.1.4. Structural model assessment

The reliable and valid measurement model estimation led to the assessment of the structural model. A crucial aspect of evaluating predictive power is the coefficient of determination (R^2) of the endogenous latent variables. In PLS path models, R^2 values of 0.67, 0.33 and 0.19 are described as substantial, moderate and weak, respectively (Chin, 1998). The R^2 value for effective learning is 0.492, indicating that it has a moderate level of predictive power (Ringle et al., 2012).

Bootstrapping was used to test the hypotheses and assess the significance of the path coefficients (Hair et al., 2017). A resampling procedure of 5000 iterations was conducted using the 216 observations. The path coefficient from waning motivation to effective learning is -0.114 ($t = 1.948$, $p = 0.051$), supporting H1. The path coefficient from inadequate feedback to effective learning is -0.404 ($t = 5.318$, $p < 0.001$), supporting H2. The path coefficient from negative emotion to effective learning is -0.140 ($t = 1.971$, $p = 0.049$), supporting H3. The path coefficient for the direct effect of DLPs on effective learning is 0.100 ($t = 1.819$, $p < 0.10$), supporting H4a. The moderating effects of DLPs on waning motivation, inadequate feedback and negative emotion were not significant ($\beta = -0.018$, $t = 0.290$, $p = 0.771$; $\beta = 0.040$, $t = 0.407$, $p = 0.684$; $\beta = -0.029$, $t = 0.425$, $p = 0.671$, respectively), and therefore H4b, H4c and H4d were not supported. Among the control variables, home/international status was significant ($\beta = 0.373$, $t = 3.420$, $p = 0.001$), while gender was not ($\beta = 0.002$, $t = 0.023$, $p = 0.982$). The results of the hypothesis testing are presented in Fig. 2 and Table 4.

The findings reveal that the primary obstacles to effective learning during crises are waning motivation, inadequate feedback, and negative emotions. Furthermore, while the use of DLPs has a positive influence on effective learning, our moderation analysis confirms that their role in addressing the challenges of waning motivation, inadequate feedback, and negative emotions was not found to be statistically significant.

We further examined whether potential multicollinearity problems existed by calculating the variance inflation factors (VIFs) and tolerance values for all variables. According to Hair et al. (2017) and O'Brien (2007), VIF values exceeding 5 and tolerance values below 0.2 indicate possible multicollinearity. In our analysis, VIF values ranged from 1.033 to 2.332, and tolerance values were all greater than 0.4288, demonstrating that none of the variables exhibit levels indicative of multicollinearity (see Table 5).

Table 2a
Principal component analysis for CMV

Total	Initial Eigenvalues % of variance	Cumulative %
1	7.835	41.235
2	1.605	8.445
3	1.415	7.446
4	1.179	6.205
5	1.116	5.875

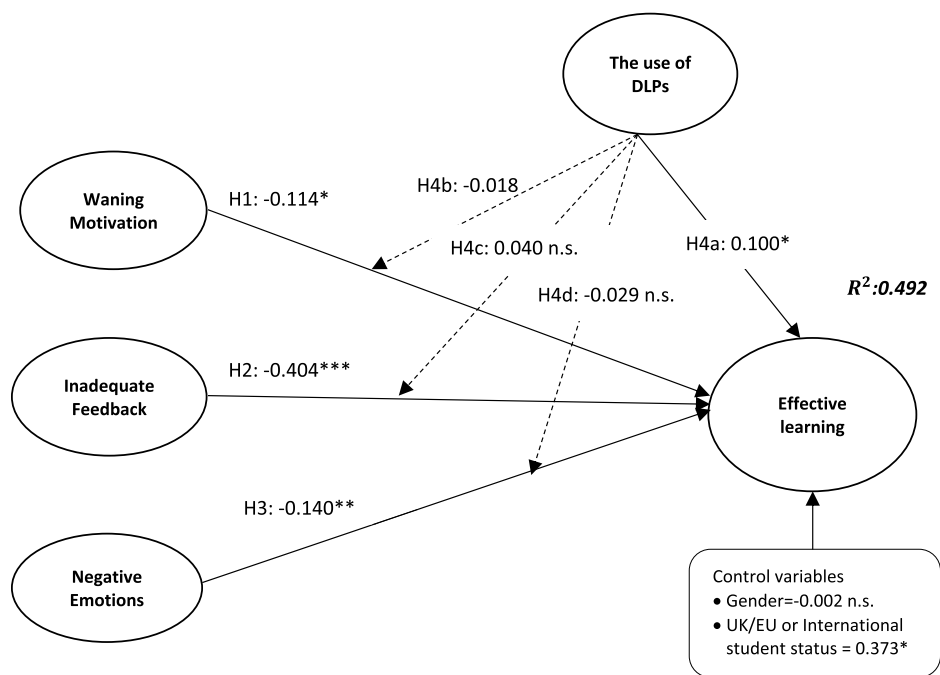
Table 2b
Common method bias (VIF scores)

Construct Items	VIF	Construct Items	VIF
WM 1	1.142	FDB 3	3.118
WM 2	2.484	FDB 4	3.311
WM 3	2.505	DLP 1	1.697
NE 1	2.535	DLP 2	1.697
NE 2	2.715	EL 1	1.928
NE 3	1.745	EL 2	2.067
NE 4	2.753	EL 3	2.018
NE 5	2.462		
FDB 1	2.154		
FDB 2	2.37		

WM: Waning motivation, NE Negative emotions, FDB: Inadequate feedback.
DLP: The use of digital learning platforms, EL: Effective learning.

Table 3
Collated results of discriminant validity assessments

	Fornell-Larcker Criterion					Heterotrait-Monotrait Ratio (HTMT)				
	1	2	3	4	5	1	2	3	4	5
1. Effective learning	0.872									
2. Negative Emotion	-0.569	0.812				0.651				
3. Inadequate Feedback	-0.633	0.680	0.877			0.726	0.766			
4. Waning Motivation	-0.534	0.673	0.631	0.810		0.684	0.849	0.783		
5. The use of digital learning platforms	0.309	-0.301	-0.284	-0.210	0.904	0.375	0.367	0.339	0.293	



Note: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, n.s. not significant

Fig. 2. Assessment of the structural model

Note: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, n.s. not significant.

Table 4
Assessment of the structural model

Hypothesized relationships	Standardised coefficient	t-statistic	P-value	Statistically significant?
H1: Waning Motivation - > Effective learning	-0.114	1.948	0.051	Yes
H2: Inadequate Feedback - > Effective learning	-0.404	5.318	0.000	Yes
H3: Negative Emotion - > Effective learning	-0.140	1.971	0.049	Yes
H4a: The use of digital learning platforms - > Effective learning	0.100	1.819	0.069	Yes
H4b: The use of digital learning platforms - > waning motivation* Effective learning	-0.018	0.29	0.771	No
H4c: The use of digital learning platforms - > inadequate feedback* Effective learning	0.040	0.407	0.684	No
H4d: The use of digital learning platforms - > negative emotion* Effective learning	-0.029	0.425	0.671	No
Gender → Effective Learning	0.002	0.023	0.982	No
Student Status → Effective Learning	0.373	3.42	0.001	Yes

Table 5
Multicollinearity test

Variables	VIF	Tolerance
Gender	1.033	0.9681
Home/International Student	1.182	0.8460
The use DLPs	1.366	0.7321
Negative Emotions	2.332	0.4288
Inadequate feedback	2.239	0.4466
Waning motivation	1.880	0.5319

4.2. Qualitative findings

The qualitative findings provide nuanced insights into students' experiences with DLPs, highlighting distinct challenges and opportunities across multiple dimensions. This section presents the key themes that emerged, focusing on motivation, engagement, feedback mechanisms, and emotional well-being in the context of crisis-driven online learning. The themes and corresponding sub-themes illustrate how students navigated the digital learning environment and pinpoint specific areas where online provision can be strengthened. Illustrative student quotations aligned with each theoretical category, theme, and code are presented in Table 6 (Appendix).

4.2.1. Motivation

The following three themes, *Digital Learning Accessibility and Experience*, *Engagement and Interactivity*, and *Instructors' Role*, are grouped under the broader theoretical category of motivation. Together, they reflect the multifaceted ways in which DLPs shaped, supported, or hindered students' motivation to learn during the crisis. While each theme captures a distinct set of concerns, they are closely interrelated and collectively highlight the structural, social, and pedagogical conditions that influenced student motivation in online learning environments.

4.2.1.1. The impact of digital learning accessibility and experience on student motivation. A prominent theme within the data is the accessibility and overall experience of digital learning. Students identified several factors affecting their learning experience, such as technical issues, inclusivity, and study environment conditions.

A common sub-theme revolved around technical challenges that impeded students' engagement with learning materials. Many students highlighted issues such as slow loading times and malfunctions in the DLPs used for lectures. For instance, one student emphasised the need to “*make sure that all applications needed are ready for the students to use and minimise any problems that may be encountered.*” Another student shared a similar concern, stating, “*Loading speed is quite slow when students open the Blackboard Ultra and lecture podcast.*” These technical difficulties not only caused frustration but also disrupted students' focus and engagement, ultimately diminishing their motivation to learn.

A key sub-theme under accessibility was the need for greater inclusivity, particularly for students with technological constraints. One student, restricted by a Ministry of Defence (MOD) household policy, noted: “*No reliance on Zoom ... I am unable to use Zoom owing to MOD blanket ban.*” Others highlighted global disparities in internet access, especially among international students. As one put it: “*Considering some people come from all over the world ... it's just unfair and senseless to assess a group of students this way.*” These comments stress the need to consider diverse technological circumstances when designing digital learning environments, including offering alternative platforms to ensure equitable access.

The physical learning environment also emerged as a critical factor influencing motivation. Students reported difficulties maintaining structure and focus in online settings. One respondent shared: “*Face-to-face learning gives every student day a structure ... With online learning, I was not motivated to do anything at all ... I live, sleep and study in the same room.*” This reflects how the lack of separation between study and personal space negatively impacted motivation and productivity. Overall, the findings suggest that digital learning

transitions can undermine academic performance, particularly when students lack adequate access to technology or a supportive physical environment for effective online learning. Beyond technical and access-related concerns, students also raised important issues about how the structure and interactivity of online teaching influenced their motivation, as explored in the next theme.

4.2.1.2. Engagement and interactivity as factors influencing student motivation. A second prominent theme related to motivation centres on student engagement and the level of interactivity in digital learning. Students voiced concerns about their ability to actively engage with both the content and their peers in an online environment, which, in turn, negatively impacted their motivation to learn. The lack of interactive opportunities often led to feelings of disengagement, highlighting the need for more dynamic and participatory learning experiences to sustain student interest and drive.

The need for smaller, more intimate learning environments emerged as a key solution to enhancing student engagement in online learning. While DLPs were utilised to replicate the physical classroom for large lecture sessions, student feedback highlighted that organising online sessions in smaller groups could significantly boost motivation. One student remarked, *“Smaller groups would make participation much easier and less stressful.”* The non-face-to-face nature of DLPs often limits interactivity; however, smaller groups could foster better participation, provide more personalised attention, and ultimately enhance the overall learning experience for students.

Students emphasised the importance of real-time learning and active participation in online education. One student remarked, *“Lectures, if online, should be delivered live via video conferencing, rather than being pre-recorded.”* Another student shared a similar view, stating, *“Having all lecturers on board with the e-learning tools (like Blackboard Collaborate) instead of some simply providing lecture recordings from previous years.”* Live sessions provide an opportunity for students to actively engage in discussions and clarify doubts immediately, fostering a more interactive and engaging learning experience. This dynamic environment was perceived to boost motivation to participate and support learning. Students felt that attendance during online sessions influenced their motivation to learn. A student commented, *“Poor turnout of students (in a class of 15+ students, our Zoom calls were often only 2–3 as no one else attended) significantly hindered discussions, could potentially make this compulsory.”* This lack of participation detracts from the learning experience, as fewer students contribute to the discussions, limiting engagement.

To address this, students suggested incorporating participation as part of the grading structure: *“Have a small percentage of the grade (e.g., 10 %) for participation in online tutorials/discussion forums so that we are encouraged to keep up to date with the material.”* Students believed that incentivising attendance and participation could help ensure that they remain engaged and motivated throughout their learning process. Another sub-theme in this area was the use of learning videos as additional digital learning resources to support students' learning. Several students suggested that instructors could create additional content and make it available on DLPs to help reinforce key concepts. One student mentioned, *“The lecturers can make more videos for students to recap and understand the content of the programme.”* This suggests that students value more dynamic, varied forms of content delivery to support their learning. These challenges with participation and peer interaction were compounded by students' perceptions of the instructor's role and preparedness, which further influenced their motivation.

4.2.1.3. Instructor competence in managing digital learning platforms and fostering student motivation. The role of the instructor in online learning environments emerged as another central theme influencing motivation. Students discussed the effectiveness of their lecturers, their enthusiasm, preparedness, and training in digital tools.

A key sub-theme that emerged was the importance of instructor enthusiasm and commitment in fostering motivation. Students highlighted the need for instructors to adopt more energetic and engaging teaching approaches in online settings. A student remarked, *“More energy from the professor, it needs to transmit the passion about the subject.”* Students indicated that a lack of visible enthusiasm from instructors made it harder for them to stay motivated online.

Another important factor influencing student motivation is instructors' preparedness in using DLPs. Several students voiced frustration over instructors' unfamiliarity with the necessary tools for online teaching. One student noted, *“Having staff fully trained on how to use the resources provided so that lecturers are not spending already limited time trying to figure out how to use the resources provided.”* This indicates a significant gap in instructor training that needs to be addressed to ensure more effective online teaching. While DLPs offer features that could enhance learning, insufficient instructor proficiency in using these tools was perceived to limit their effectiveness and negatively affect student motivation.

4.2.2. Creating effective feedback mechanisms

Effective feedback mechanisms are critical to student success in any learning environment. In the digital learning context, students highlighted several aspects of feedback that influenced their capacity to learn effectively.

A primary concern was the quality and timeliness of feedback in online settings. One student pointed out, *“Due to the online nature of much of the learning, staff could not necessarily get back to us in time or provide the same quality of support as in traditional circumstances.”* This delay in feedback was perceived as a significant barrier to learning progress, underscoring the need for more efficient and consistent feedback processes. Students emphasised the importance of receiving *“Proper, frequent and consistent feedback”* to support their academic development. In particular, the use of discussion boards was identified as an effective feedback channel, as it facilitated quick and high-quality responses from instructors. As one student noted, *“Quality of the discussion board and the speed of the response from the instructor”* were vital elements that contributed to their learning experience. Some students recommended more frequent check-ins and touchpoints with instructors as a strategy that can allow students to receive more support and feedback. A student proposed, *“Perhaps ‘touch-in’ online sessions during the week for groups of the class to join if they want to discuss extra reading/questions or concerns.”* Similarly, another student proposed having *“more interactive Q&A sessions between the teacher and students during live classes”*

as a means to enhance the feedback mechanism. This reflects a need for more personalised engagement between students and instructors to enhance feedback provision and sustain motivation.

4.2.3. Providing emotional support for student well-being

Finally, emotional well-being emerged as an important theme in students' online learning experiences. Students expressed the need for greater emotional support to manage the challenges associated with remote learning. Many students felt that their emotional well-being was not adequately supported in digital learning environments. One student recommended, "*More one-on-one discussions with teachers to assess a student's well-being, etc.*" Similarly, another student suggested introducing dedicated sessions to monitor students' emotional health, such as "*motivational/check-in sessions or similar, to help navigate challenging times.*" These comments highlight a desire for increased personal interaction with instructors to support students' emotional well-being and provide the necessary assistance.

To boost student engagement and support their emotional well-being, students suggested incorporating more diverse and meaningful activities. One student mentioned, "*Giving students new tasks that make them interested in moving forward in this path which is online learning (especially since they were used to studying face-to-face and did not choose to study online from the beginning and thus attracting them to this path is a motivating matter).*" Such engagement may help reduce feelings of isolation and disconnection in an online setting, thereby supporting students' emotional well-being.

Another major concern was access to learning resources. Students pointed out that online library resources were often inadequate, with some key texts only available in physical form. The limited digital access to these materials hindered their ability to fully engage with the course content, causing increased frustration and stress. Improving access to online and digitised materials is, therefore, crucial for fostering a more supportive and engaging digital learning environment. This underscores the need for universities to invest in more extensive digital resources to better support students in their studies.

The qualitative analysis of student responses reveals several important insights into their experiences with digital learning. The findings indicate that while students appreciated the flexibility and convenience of learning through DLPs, they also faced challenges, including technical issues, engagement barriers, and limited emotional and academic support. Table 6 (Appendix) presents additional student quotations that further illustrate these key themes. Addressing these challenges by improving the accessibility of digital platforms, enhancing interactivity, and strengthening instructor training could contribute to more effective and fulfilling learning experiences. By taking these factors into account, universities can create more inclusive, supportive, and engaging online learning environments.

5. Triangulation of qualitative and quantitative findings

This section presents a triangulation of the findings by integrating key quantitative outcomes with qualitative themes and codes, thereby highlighting areas of convergence, complementarity, and divergence (Creswell & Plano Clark, 2018). Quantitative analysis demonstrated that DLPs had a direct and statistically significant effect on promoting effective learning, although their moderating influence on crisis-related challenges (waning motivation, inadequate feedback, and negative emotions) was not supported. Qualitative findings provide explanatory insight into these results by revealing how students' experiences reflected these constructs, consistent with established literature.

To present these insights systematically, Table 7 (Appendix) consolidates the triangulated quantitative and qualitative findings together with targeted improvement strategies and their strategic implications.

5.1. Motivation

The non-significant moderation for motivation (H4b) is illuminated by three main themes: Digital Learning Accessibility and Experience, Engagement and Interactivity, and Instructor Role.

Digital Learning Accessibility and Experience. Students reported persistent technical difficulties, unstable internet connections, platform breakdowns, and unequal access to devices, that disrupted learning flow and diminished motivation to persist (Woodrow, 2017; Keller & Suzuki, 2004). Weak digital infrastructure, inclusivity gaps, and unsupportive home environments further hindered concentration and reduced students' sense of competence and fairness, both key determinants of sustained motivation (Deci & Ryan, 2000; Skinner et al., 2009; Broadbent & Fuller-Tyszkiewicz, 2018).

Engagement and Interactivity. Motivation was further weakened by limited opportunities for small-group collaboration and real-time interaction. Students explained that these absences curtailed peer support and active participation, echoing research that highlights synchronous, collaborative activities as essential to fostering belonging and engagement (Redmond et al., 2018; Martin & Bolliger, 2018). They also emphasised that shorter, well-structured instructional videos could promote autonomy and readiness for live sessions, aligning with findings that clear content design enhances engagement (Castelli & Sarvary, 2021; Hollister et al., 2022). Low attendance, both a symptom and cause of disengagement, was also noted as a factor eroding motivation over time (Dixson, 2015).

Instructor Role. Lecturer enthusiasm and presence emerged as critical motivational drivers. Students described how instructors who conveyed passion, energy, and responsiveness created a sense of connection and purpose that elevated engagement. Conversely, when instructors lacked digital fluency or session structure, participation declined. These experiences reinforce prior evidence that instructor immediacy, enthusiasm, and competence are central to sustaining motivation in digital learning environments (Swan, 2002; Sharp & Sharp, 2016; Shin & Hickey, 2021; Martin et al., 2019).

Collectively, these findings suggest that DLPs did not mitigate motivational decline, as students' accounts highlighted persistent

technical, social and instructional barriers that are well-documented antecedents of reduced motivation.

5.2. Feedback

The non-significant moderation for feedback (H4c) is explained by the theme of Guidance and Instruction. Students reported delays, inconsistencies, and fragmented communication that limited their ability to act on feedback, conditions shown to reduce its effectiveness (Nicol & Macfarlane-Dick, 2006; Shute, 2008; Hattie & Timperley, 2007). The absence of regular online touchpoints such as office hours or live Q&A further restricted opportunities for clarification, echoing evidence that predictable interaction fosters comprehension and confidence in online learning (Lowenthal et al., 2017; Hollister et al., 2022; Martin & Bolliger, 2018). Collectively, these gaps, including delayed responses, lack of standardisation and limited access to instructors, undermined the formative role of feedback and offer insight into why DLPs did not significantly moderate feedback-related challenges during crises.

5.3. Emotion

The non-significant moderation for negative emotions (H4d) is explained by the theme of Emotional Well-being in Digital Learning. Students described the lack of regular check-ins and personalised interaction, which left stress, anxiety, and isolation unaddressed, conditions known to heighten emotional strain in online learning (Bustos-Contell et al., 2021; Hasan & Bao, 2020; Shohel et al., 2021). They also called for greater variety in course activities, including quizzes, interactive tasks, and opportunities for practical application, as monotonous designs are shown to increase boredom and weaken emotional engagement (Pekrun, 2006). Limited access to digital materials further contributed to frustration, aligning with findings that resource availability is fundamental to emotional well-being and sustained engagement in digital environments (Aguilera-Hermida, 2020; Aryee & Apronti Tetteh, 2024). Collectively, these issues, namely insufficient socio-emotional support, monotonous instructional design and restricted access to resources, undermined the conditions necessary for emotional stability and provide insight into why DLPs did not significantly moderate negative emotions during crises.

6. Discussion

This study deepens understanding of how digital learning platforms (DLPs) support effective learning during crises by examining the extent to which they shape students' experiences of waning motivation, inadequate feedback, and negative emotions. In doing so, it offers novel insight into online learning pedagogy by reassessing the role of DLPs within crisis-affected educational contexts.

Our findings show that students perceived waning motivation, inadequate feedback, and negative emotions as major barriers to effective learning. These results align with prior research demonstrating that crisis conditions heighten difficulties related to motivation (Aguilera-Hermida, 2020; Fofana et al., 2020; Reich et al., 2020; Shin & Hickey, 2021), feedback (Flores et al., 2024; Shin & Hickey, 2021), and emotion (Clabaugh et al., 2021), largely due to the loss of face-to-face interaction and the abrupt transition to remote learning. Although DLP use was directly associated with effective learning, it did not moderate the impacts of waning motivation, inadequate feedback, or negative emotions. When interpreted alongside the qualitative evidence, these results clarify that the benefits of DLPs materialise only when platform affordances are activated through purposeful instructional design and relationally supportive, context-responsive pedagogical approaches. The following sections discuss these findings in detail.

The literature presents mixed evidence regarding the impact of crisis-induced transitions to online learning on students' motivation. Rahiem (2021) found that students remained motivated despite the challenges associated with the transition to online learning during the pandemic. Similarly, a few other studies also suggest that students were able to sustain their motivation in online learning settings (Rahm et al., 2021; Besser et al., 2022). However, the majority of research underscores the detrimental impact of crises on student motivation, which eventually affects student learning (Aguilera-Hermida, 2020; Reich et al., 2020; Shin & Hickey, 2021). For instance, Fofana et al. (2020) reported that the uncertainty caused by crises reduces motivation, ultimately impeding effective learning. In line with this broader evidence, our findings also reveal that a lack of motivation represented a significant barrier to effective learning.

Another major barrier to student learning identified in the literature during crisis periods is the absence of adequate feedback mechanisms (Flores et al., 2024; Shin & Hickey, 2021). Scholars mainly argue that the abrupt transition to online teaching during the pandemic disrupted the provision of timely and constructive feedback, ultimately hindering students' learning outcomes (Flores et al., 2024). Our study further supports this view, with inadequate feedback emerging as the most significant obstacle to effective learning in our research context.

Finally, our research identified negative emotions as an additional barrier to effective learning. This finding is consistent with earlier studies that have highlighted emotional challenges as a critical concern for students in crisis-induced online learning settings (Cao et al., 2020; Savitsky et al., 2020; Shao et al., 2024; Visser & Law-van Wyk, 2021). Social isolation, uncertainty, and insufficient emotional support have been recognised as key factors contributing to heightened emotional distress, ultimately undermining effective learning. Consequently, this research underscores the importance of understanding these challenges and implementing targeted strategies that enhance students' motivation, provide timely and constructive feedback, and support emotional well-being during crises. Addressing these needs through tailored support has been shown to improve students' engagement, productivity, and overall learning performance (Chen & Jang, 2010).

To explain the absence of a moderating effect, the following paragraphs draw on qualitative evidence to unpack each challenge. We begin with motivation, examining how the perceived value of DLPs was contingent on their alignment with purposeful instructional

design and relational support mechanisms. Despite evidence that digital learning can enhance motivation under stable conditions (Lin et al., 2017), our findings indicate that, during crisis deployment, DLPs did not activate motivational support when these instructional and relational mechanisms were absent. Technical and accessibility problems, unstable connections, platform breakdowns, and inadequate support for diverse learners, disrupted continuity and produced frustration, disrupting the sense of competence and autonomy that sustains motivation (Deci & Ryan, 2000; Hollister et al., 2022). Unfavourable home environments further eroded focus and persistence, revealing that even well-designed platforms may not compensate for the structural inequalities and environmental constraints intensified by crisis conditions. More critically, the study highlights a marked weakening of social presence, a core dimension of the Community of Inquiry (CoI) framework (Garrison et al., 2000), as a central cause of motivational decline. Students described online classes as isolating, marked by minimal peer collaboration and weak group identity. This absence of interaction severed the relational scaffolding through which purpose and belonging are sustained, echoing prior evidence that community cohesion is fundamental to persistence in online learning (Bonk & Khoo, 2014; Redmond et al., 2018). Motivation, in this context, depends less on platform functionality than on the capacity to recreate genuine social engagement. Smaller seminar groups, regular synchronous sessions, and concise asynchronous resources can strengthen this social infrastructure and restore a sense of connectedness and agency (Castelli & Sarvary, 2021; Hollister et al., 2022). Equally, the erosion of teaching presence emerged as a decisive factor. Students repeatedly tied motivation to instructors' enthusiasm, responsiveness, and digital competence, qualities that foster clarity, immediacy, and trust. When these were absent, disengagement accelerated. This supports earlier findings that instructor presence is the emotional and organisational anchor of online motivation (Sharp & Sharp, 2016; Shin & Hickey, 2021; Swan, 2002). Overall, the results challenge the assumption that technological infrastructure can substitute for pedagogical presence. In crisis contexts, DLPs enhance motivation only when activated through interactive communities supported by empathetic, well-prepared instructors who can re-establish connection and purpose. Effective digital learning therefore hinges less on access to technology than on the re-creation of human presence within it (Lemay et al., 2021).

While DLPs are often praised for enhancing the reach and efficiency of feedback (Van der Kleij et al., 2015; Fine et al., 2022), our findings reveal that, in crisis contexts, these tools failed to deliver on that promise. The transition to remote learning dismantled established feedback loops: communication became asynchronous, fragmented, and largely one-directional. Students described feedback as delayed, inconsistent, and detached from their learning process, exposing a gap between the technical affordances of DLPs and the pedagogical presence required to sustain formative dialogue. This breakdown is best understood as an erosion of teaching presence, one of the core components of the Community of Inquiry framework (Garrison et al., 2000). Effective feedback depends on instructors' capacity to design, facilitate, and direct learning interactions. Under emergency conditions, these elements were weakened simultaneously: design structures were improvised, facilitation was constrained by time and technological limitations, and direction, the interpretive guidance that gives feedback meaning, was often absent. Students' accounts of empty discussion boards, unpredictable office hours, and non-responsive instructors illustrate how the loss of dialogic immediacy transformed feedback from a relational process into a procedural transaction. Equally significant was the weakening of cognitive presence. Without consistent dialogue or real-time clarification, students struggled to test understanding or integrate new concepts, halting progression through the exploration and resolution stages of learning (Garrison et al., 2000). Some students sought stability through simple structuring tools, such as weekly progress checklists and tick-box worksheets, which provided minimal scaffolding and restored a sense of direction. These accounts underline that even basic feedback routines can help re-establish continuity when formal channels fail. Ultimately, feedback failure stemmed less from technological limitations than from the absence of sustained pedagogical presence. The crisis exposed how DLPs, when stripped of structure and presence, reduce learning to information delivery. Re-establishing teaching presence through predictable touchpoints, structured feedback cycles, and transparent communication can restore the relational and cognitive dimensions of feedback. DLPs enhance learning only when they recreate the dialogic continuity that makes feedback formative rather than administrative.

Our findings show that while DLPs maintained instructional continuity, they failed to address the emotional strain students experienced during crises. Students reported persistent feelings of isolation, anxiety, boredom and frustration, citing the lack of regular check-ins and personal communication with instructors. This reflects a breakdown in social presence, the sense of connection, empathy, and belonging central to the Community of Inquiry framework (Garrison et al., 2000). When social presence weakens, interaction becomes transactional rather than relational, depriving learners of the affective support needed to manage stress and sustain concentration. This gap represents a breakdown in what Hammond & Gibbons, 2005 call emotional scaffolding, the empathy, encouragement, and responsive communication through which instructors help students regulate negative affect, alleviate anxiety, and rebuild psychological balance in uncertain conditions. In its absence, students' emotions remained unmoderated, and technology alone could not compensate for the loss of human reassurance and immediacy that face-to-face education provides. Monotonous and uninteractive course designs further intensified negative emotions such as boredom and frustration. Students emphasised the need for greater variety and purpose in online activities, quizzes, applied projects, and reflective discussions, to sustain emotional involvement. As predicted by control-value theory (Pekrun, 2006), learners experience positive emotions when they perceive agency and value in their tasks; when activities are passive or rigid, boredom and frustration set in, draining focus and persistence. Well-designed, interactive tasks restore a sense of control and purpose, stabilising emotion and reinforcing engagement. Emotional strain was also amplified by limited access to essential digital resources and the frustration of navigating poorly integrated systems. Students who struggled to locate readings or access course materials described heightened anxiety and helplessness. These experiences echo Aguilera-Hermida (2020) and Aryee & Apronti Tetteh (2024), who show that equitable access is not merely a logistical matter but a determinant of emotional well-being and persistence in online learning. Together, these findings demonstrate that emotional resilience in digital education depends less on technological provision than on the design of emotionally responsive learning environments. Strengthening social presence through regular well-being check-ins, diversifying activities to sustain agency and value, and ensuring equitable resource access were viewed as important for reducing emotional strain. Ultimately, digital learning succeeds only when it rehumanises the screen, transforming platforms from

functional delivery systems into spaces of connection, empathy, and shared purpose.

Overall, these findings indicate that the effectiveness of DLPs depends not only on their technological affordances but on the quality of human engagement and pedagogical orchestration surrounding their use. Variation in how instructors designed learning activities, structured feedback, and sustained online presence shaped the degree to which DLPs supported motivation, learning, and emotional stability. Likewise, students' differential capacities to navigate, interpret, and participate in digital environments influenced the extent to which platforms functioned as enablers or barriers to learning. Although our data were confined to students' perspectives, their accounts consistently pointed to how instructor behaviour, particularly enthusiasm, preparedness and responsiveness, shaped their perception of the value of DLPs. These insights underscore that technology alone cannot account for learning variation: its impact is co-constructed through the interplay of digital affordances, pedagogical design, and human agency. In this sense, the potential of DLPs lies not in their capacity to replicate traditional classrooms, but in their ability to cultivate adaptive, relational, and emotionally responsive forms of presence that sustain learning under conditions of uncertainty.

7. Theoretical and practical implications

This study examined the effectiveness of DLPs in addressing three critical challenges of crisis-driven education, low motivation, inadequate feedback, and negative emotions, to support effective student learning. The findings make both theoretical and practical contributions to digital pedagogy by showing that technological provision alone does not ensure learning continuity. DLPs are most effective not as standalone tools but as components of a broader learning ecology in which design, interaction, and affective engagement are deliberately integrated to sustain learning under disruption.

Theoretically, this study advances digital pedagogy research by demonstrating that the effectiveness of DLPs depends on the integration of technological, pedagogical, social, and emotional supports. Learning outcomes are determined less by the platform in isolation and more by how its affordances are integrated with pedagogical, social and emotional supports to reconstruct the relational, cognitive and affective foundations necessary for engagement and persistence.

Earlier research often presents DLPs as technical enablers that inherently enhance motivation, feedback, and learning outcomes when properly implemented (Lin et al., 2017; Van der Kleij et al., 2015). Such studies typically assess platform functionality or feedback mechanisms in isolation, assuming that technology adoption alone generates pedagogical benefits. In contrast, our findings challenge this assumption. In crisis contexts, DLPs did not significantly improve students' motivation, feedback experiences, or emotional well-being. Qualitative evidence suggests that their effectiveness depends on how technological affordances are aligned with pedagogical design and instructor engagement. When these human and structural supports were weak, through delayed communication, limited interaction, or poor content organisation, learning processes across all three domains suffered. This reframes DLPs as socio-technical systems whose value depends on instructional mediation and the intentional alignment of technological features with supportive pedagogical practices.

The Community of Inquiry (CoI) framework (Garrison et al., 2000; Garrison, 2016) informed the conceptual framing of the moderating effects and provides a coherent interpretive lens through which to understand the findings. The observed breakdowns in motivation, feedback, and emotion highlight wider disruptions that intersect with weaknesses in CoI's presences. Social presence eroded as interaction and belonging declined; teaching presence faltered when feedback and direction became inconsistent; and cognitive presence was affected where limited dialogue reduced opportunities for learners to test understanding and sustain reflective engagement. These patterns help situate our findings within established online learning theory, showing that presence is not merely a desirable condition but a stabilising mechanism during disruption. The results also underscore the importance of emotional scaffolding (Hammond & Gibbons, 2005), the empathy, encouragement, and responsive communication that help learners regulate affect and sustain engagement under uncertainty. By integrating this affective layer, the study extends theoretical understanding of how DLPs operate as both cognitive and emotional environments in crisis-driven education.

Practically, the findings offer guidance for educators, higher education institutions, and policymakers designing resilient digital learning systems. First, institutions must prioritise equitable access to stable, user-friendly platforms. Technical breakdowns and uneven digital access were persistent demotivators, particularly for students learning in constrained home environments. Second, course design should focus on interactive engagement rather than passive content delivery. Smaller seminar groups, live discussions, and modular asynchronous materials were consistently identified as strategies that restore connection, agency, and motivation. Third, instructors must be equipped with the pedagogical and technological competence to maintain presence in digital settings. Their enthusiasm, clarity, and responsiveness were repeatedly cited as determinants of student engagement, underscoring the need for targeted faculty training in online pedagogy.

Feedback systems require special attention. Students' experiences confirmed that delays, inconsistencies, and unclear communication were the most damaging barriers to learning. Institutions should implement structured feedback protocols and predictable online interactions, such as weekly progress check-ins or virtual office hours, to restore dialogue and ensure feedback is actionable. Emotional support must also be embedded within digital pedagogy, not as an optional add-on but as a design principle. Regular well-being check-ins, empathetic communication, and accessible counselling or peer-support channels can mitigate anxiety and isolation, strengthening students' emotional resilience.

Finally, these findings have broader policy relevance. Aligning with Sustainable Development Goal (SDG) 4, which calls for inclusive and equitable quality education, this study suggests that effective digital learning depends on the integration of three components: competent educators, engaged learners, and accessible technologies (Muñoz-Najar et al., 2021). Policymakers must therefore move beyond platform provision to foster pedagogical capacity and student engagement, ensuring that DLPs are implemented as holistic learning ecosystems rather than technical stopgaps.

8. Conclusion, limitations and future research

While our study offers valuable insights into the role of DLPs, several limitations should be acknowledged. First, the reliance on self-reported measures, particularly for assessing emotional engagement, may be subject to bias, potentially influencing the findings. Second, the sample comprised students from UK institutions, which may limit the generalisability of the results to more diverse learner populations. These factors may have contributed to the non-significant finding related to emotional engagement (H3). For example, students from emerging markets might encounter different or additional challenges due to the lack of digital infrastructure. Accordingly, future research could either focus on different contexts or apply a comparative perspective to reveal how context-specific factors might affect the effectiveness of DLPs. Moreover, future research could benefit from employing longitudinal designs and multi-source data collection (e.g., instructor assessments, behavioural analytics) to generate a more nuanced and generalisable understanding of learner engagement in digital contexts.

This study examined the perceived role of DLPs during crises from the students' perspective, offering valuable insight into user experience but not capturing potential variation in how instructors implemented and managed the platforms. Differences in instructional approaches, levels of engagement, and feedback practices may influence how effectively DLPs support motivation, feedback, and emotional well-being. Future research should therefore adopt a comparative design that incorporates both student and instructor perspectives to provide a more comprehensive understanding of these dynamics. Such research could reveal how differences in teaching practices and learner engagement shape DLP outcomes, and identify strategies for optimising platform use across both groups. Integrating these perspectives would strengthen the evidence base for designing digital pedagogies that effectively address motivational, feedback, and emotional challenges in crisis-driven online learning.

This study used a cross-sectional approach, with data collected during the pandemic. As the higher education sector continues to shift towards remote learning, future research applying a longitudinal approach could provide insights into how the effectiveness of DLPs evolves over time in meeting students' needs. Furthermore, our findings indicate that students from different regions of the world had varying experiences with remote teaching during the pandemic due to accessibility and infrastructure issues tied to their locations. This highlights the important role of the digital divide in education, suggesting that it may exacerbate inequalities in students' learning experiences. Future research could further examine the nuanced effects of the digital divide on students' learning effectiveness during crises, offering valuable insights for policy decisions and interventions aimed at addressing these educational disparities. Furthermore, given the correlational nature of this study, conclusions regarding the direction or causality of the relationships should be interpreted cautiously, and future research is needed to establish stronger causal evidence. Finally, our study opens avenues for future research to investigate hybrid models that combine digital tools with human-centred approaches to feedback, motivation, and emotion, thereby addressing the limitations identified in this research.

CRedit authorship contribution statement

Negar Monazam-Tabrizi: Writing – review & editing, Writing – original draft, Methodology, Investigation, Data curation, Conceptualization. **Yusuf Kurt:** Writing – review & editing, Project administration, Methodology. **William il-Kuk Kang:** Writing – review & editing.

Data statement

The data that support the findings of this study are available from the first author upon request.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used ChatGPT in order to improve the readability and language of the manuscript. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

Funding sources

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of competing interest

No potential conflict of interest was reported by the author(s).

Acknowledgements

We sincerely thank the participants for their valuable input and the data they shared. We also extend our appreciation to the editor and the three anonymous reviewers for their insightful guidance and constructive feedback.

Appendix

Table 6
Themes Derived from Participant Responses

Theoretical categories	Themes	Codes	Exemplar quotations
Motivation	Digital Learning Accessibility and Experience	Technical issue	“Make sure that there are not constant IT issues.”, “Make sure that all applications needed are ready for the students to use and minimise any problems that may be encountered.”, “Loading speed is quite slow when students open the Blackboard Ultra and lecture podcast.”
		Inclusivity	“Low-income students should be provided adequate tools to learn fully remote.” “Considering some people come from all over the world, and some face restrictions on internet use etc. it's just unfair and senseless to assess a group of students this way.”, “No reliance on Zoom - as a student living in a household where relatives work for Ministry of Defence, I am unable to use Zoom owing to MOD blanket ban - therefore extremely disadvantaged when sessions are through Zoom.”, “They are extremely difficult to follow on a small laptop screen, especially as a disabled student.”
		Study environment	“I also think that learning effectiveness depends upon the student's circumstances. During my e-learning, I was at my parents' home with my two brothers. The house does not have an office space and even with their cooperation, it was often distracting not to be able to be in a quieter/more academic setting.”, “I understand that it is something you are not really able to change but face-to-face learning gives every student day a structure. We have to get out and get to campus, which makes us more motivated to stay there, use the library, get work done. With online learning, I was not motivated to do anything at all during the day and the environment in which I was learning or listening to classes in, was not motivating either. It is essential for me, and many others, to separate studying and relaxing which is impossible to do when I live, sleep and study in the same room.”, “Even though I work very hard, every day I remain in the same place. I have started to feel difficulties in my studies.”
	Engagement and interactivity	Small group	“Smaller groups which would make participation much easier and less stressful.”, “Making the study in fewer groups (reducing the number when using online communication tools).” “Conduct tutorials in smaller groups preferably less than 10 people in 1 class so the tutor gets to address the needs of every student better.”
		Real time and active learning	“Interactivity was a major issue.” “Lectures if online, should be delivered live via video conferencing, rather than being pre-recorded. It would be helpful to have more contact with the other students as they often help me understand if I have understood.”, “Heaving all lecturers on board with the e-learning tools (like Blackboard Collaborate) instead of having some simply providing lecture recording from previous years.”
		Learning videos and content	“The lecturers can make more videos for students to recap and understand the content of the program. Because sometimes I have to learn from YouTube for the same content due to the lack of the material.”, “Short explainer videos.”, “Online questions on a paper/reading material prior to taking the seminar to motivate people to do the reading and contribute better to the online class.”
		Attendance	“also poor turnout of students (in a class of 15+ students, our Zoom calls were often only 2-3 as no-one else attended) majorly hindered discussions, could potentially make this compulsory.”, “There were seminars though, were we only engaged in by submitting our answers to questions on the Discussion board. Not a lot of people contributed and therefore there was no discussion. I did not feel motivate to engage at all and by the end of the course I felt like I have not learnt anything at all.”, “Have a small percentage of the grade (e.g. 10 %) for participation in online tutorials/discussion forums so that we are encouraged to keep up to date with the material.” “Staying engaged is the most difficult part - students having their video on during seminars might help with this, although not everyone has a webcam and some people may not be comfortable with this.”,

(continued on next page)

Table 6 (continued)

Theoretical categories	Themes	Codes	Exemplar quotations
Feedback	Instructors' role	Lecturer's enthusiasm and commitment	"More energy from the professor, it needs to transmit the passion about the subject.", "The professor with fully patient and love.", "Most felt considerably more unavailable than when the university was open.", "More efficiency in uploading podcasts and lecture slides."
		Instructor's preparedness and training	"Having staff fully train on how to use the resources provided so that lecturers are not spending already limited allotted time trying to figure out how to use the resources provided.", "Tools used, lecturers must learn how to use these tools properly.", "Better vetting by lecturers on Blackboard Collaborate - some students were abusive during discussions, causing other students to leave the session."
	Guidance and instruction	Quality and timeliness of feedback	"Quality of the discussion board and the speed of the response from the instructor.", "Due to the online nature of much of the learning staff could not necessarily get back to us in time or same quality of support as in traditional circumstances.", "Proper, frequent and CONSISTENT feedback."
		Regular Online Touchpoints	"Perhaps 'touch-in' online sessions during the week for groups of the class to join if they want to discuss extra reading/questions or concerns.", "A bi-weekly/monthly check in with a tutor to check progress.", "More interactive Q&A between teacher and student during live sessions.", "More online office hours."
Emotion	Emotional Well-being in Digital Learning	Standardisation of rules and communications	"Clarity on what is expected. I felt that during this last semester it was difficult to engage with the materials as it was quite confusing what had to be completed and focused on.", "Besides, the communication from the university itself (not individual lecturers) was lacking. Hence, please just communicate clearly and all important information to ALL students.", "For each week of work a list of objectives/things to focus on would be very helpful. Furthermore, some kind of tick box worksheet would help so I know what I should be completing."
		Emotional support	"Catch up with us how we're doing.", "More discussion with teachers on an individual basis to check a student's wellbeing etc.", "Maybe motivational/check-in sessions or similar to help with pushing through the difficult times."
		Varied and Meaningful Activities	"Being given the opportunity to apply our knowledge.", "More online quizzes to test our knowledge.", "Giving students new tasks that make them interested in moving forward in this path which is online learning (especially since they were used to studying face-to-face and did not choose to study online from the beginning and thus attracting them to this path is a motivating matter)."
		Library and online materials	"More online library resources (a lot of the texts I needed were only physical copies in the library which I had no way of accessing) - although there are quite a few online resources, I still found this to be quite weak (especially when lecturers were quoting from and recommending specific texts as crucial, yet we couldn't access them)." "A large amount of the books for my course are not available online and are only available in the library. For my learning to be more effective, I would need greater access to a larger variety of online books.", "It would be beneficial if course leaders could arrange for greater provision of digitised material that is particularly relevant for coursework and to make sure that it is easily accessible on Blackboard or the reading lists online."

Table 7
Summary of triangulated findings and strategic implications

Construct	Quantitative result	Key qualitative findings	Targeted strategies/ improvements	Strategic Implications
Motivation	The moderating effect of DLPs on waning motivation during crises was non-significant (H4b).	Students identified three interrelated dimensions influencing motivation: 1. Digital Learning Accessibility and Experience: technical issues, inclusivity barriers, and poor study environments reduced focus and persistence; 2. Engagement and Interactivity: the absence of small-group activities, real-time learning, diverse content, and consistent	- Improve digital accessibility and technical reliability. - Foster online communities through smaller, interactive seminar groups and regular real-time participation. - Use short, well-structured explainer videos to free synchronous sessions for	The absence of moderation indicates that DLPs cannot restore motivation without active teaching and social presence. Motivation thrives when learners experience community, autonomy, and instructor engagement. Institutions should prioritise the design of socially cohesive, instructor-mediated digital environments where interaction and

(continued on next page)

Table 7 (continued)

Construct	Quantitative result	Key qualitative findings	Targeted strategies/ improvements	Strategic Implications
		attendance weakened peer connection and accountability; 3. Instructors' Role: limited enthusiasm, commitment, and preparedness in using DLPs diminished motivation.	collaborative, community-building discussions. - Encourage participation through visible engagement indicators or light participation grades. - Strengthen instructors' digital pedagogy and facilitation skills.	presence restore meaning and persistence.
Feedback	The moderating effect of DLPs on feedback during crises was non-significant (H4c).	Students reported three main feedback-related barriers: 1. Timeliness and Quality of Feedback: delays and inconsistencies limited students' ability to improve performance; 2. Regular Touchpoints: lack of scheduled interactions such as office hours or real-time Q&A reduced opportunities for clarification and support; and 3. Standardisation and Clarity: inconsistent rules, fragmented communication, and lack of clear instructions generated uncertainty and hindered effective use of feedback.	- Establish predictable feedback touchpoints (e.g., virtual office hours, weekly Q&A). - Standardise feedback protocols and communication rules across modules to ensure consistency. - Use structured progress-tracking tools (e.g., tick-box worksheets) to help students monitor learning goals. - Enhance instructors' responsiveness and use of visual/auditory cues to improve interaction quality.	Feedback effectiveness depends on teaching presence, the capacity to design, facilitate, and direct learning interaction. The crisis revealed that technological channels alone cannot sustain this presence. Institutions should embed structured, dialogic feedback cycles into DLP design to re-establish cognitive presence, ensuring that feedback remains formative and relational rather than administrative.
Emotion	The moderating effect of DLPs on negative emotions during crises was non-significant (H4d).	Students' accounts under the theme Emotional Well-being in Digital Learning revealed three interrelated areas: 1. Emotional support: lack of regular check-ins and personal discussions with instructors left stress and isolation unaddressed; 2. Varied and meaningful activities: students requested more applied tasks, quizzes, and opportunities to use their knowledge to sustain engagement; and 3. Library and online materials: frustration arose from limited access to essential readings and learning resources. These unmet needs heightened boredom, frustration, and detachment during online learning.	- Introduce regular one-to-one or small-group well-being check-ins - Incorporate interactive, varied, and applied learning activities (e.g., online quizzes, practical tasks). - Expand access to digitised resources and online reading materials via learning platforms. - Embed emotional support and counselling channels directly within DLPs.	Emotional regulation relies on social presence and emotional scaffolding, the empathy, encouragement, and responsive communication that help learners manage affect. DLPs must embed these supports within their pedagogical design, transforming online spaces from transactional systems into affective learning environments that sustain well-being and concentration during uncertainty.

Data availability

Data will be made available on request.

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