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DIGITAL LEARNING THAT BUILDS INDEPENDENT LEARNERS: EXAMINING TECHNOLOGY USE, SELF-REGULATED LEARNING, AND STUDENT ENGAGEMENT

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KEYWORDS

Digital learning, Independent learning, Self-regulated learning, Student engagement, Technology use, University students

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ABSTRACT

This study explored the role of digital technology in supporting independent learning and focused on three research areas related to students, digital technology, and self-regulated learning: digital technology and students' use of it, self-regulated learning and students' use of it, and students' involvement in learning processes in terms of learning, learning approaches, and motivation to learn. The design of the study is quantitative research and cross-sectional survey type giving an exploratory perspective aimed at gaining an understanding about students' experiences in digital learning environments. Proposium for university students selection for this sample was based on the convenience sampling which includes 300 students from various disciplines of universities at different levels. The data were obtained using a structured questionnaire with a 5-point likert scale and then analyzed using descriptive statistic which includes Frequency, Percentages, Mean and Standard deviation. The results indicated that the students used online videos and recorded lectures frequently (63%), and learning management systems frequently (58%). On the other hand, the use of artificial intelligence learning tools was infrequent or irregular by 33% of users. Conversely, 32% of users frequently used artificial intelligence learning tools, while 33% rarely or never did so. The overall mean score for SRL was 3.57 (SD = 0.96), and goal setting had the highest mean (M = 3.71) and concentration the lowest (M = 3.39). The overall mean of student engagement was 3.58 (SD = 0.95). The strongest engagement score was for effort to understand difficult academic concepts (M = 3.73), while maintaining interest had the lowest score (M = 3.42). The results showed that participants' self-regulated learning and engagement was at a moderately positive level. Purposeful use of technology, purposeful learning activities, progress monitoring, and feedback, were identified as important for supporting independent learning, were noted in the study.

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Introduction

Digital learning had grown as an important role in higher education as it was integrated in the university's teaching and learning practices. The changes allowed students to access academic resources; complete their tasks; communicate with their tutors and engage in academic tasks outside of class. In addition to the available technology, the impact of digital learning on education was ranked based on how the technology was used in order to help student learning goals. Research showed that when digital technologies are aligned with suitable educational content and pedagogical strategies, and involve the students in learning, then learning is supported (Bond et al., 2020).

Individually setting learners' learning objectives, using appropriate learning strategies, self-monitoring and evaluating their own learning were highlighted as components of self-directed learning within SLD. Students who used SRL strategy were able to plan, reflect, organize the learning process more systematically, and overcome lack of learning materials by planning, reflecting and adjusting the learning approach. Broadbent and Poon (2015) analyzed several SRL strategies, finding that time management, metacognition, effort management and critical thinking strategies play an important role in predicting academic achievement in higher education environments like online learning. Recently, Wong et al. (2019) presented SRL studies through an approach that involved learners' behaviors in the learning environments that incorporate technology. The results of this work showed the students' learning management and how they made use of it rather than being led to believe that their digital access automatically made them more independent in their learning processes.

Student engagement was also found to be an important element in gaining understanding of the effectiveness of digital learning because it was manifested as student behaviour participation, emotional participation and cognitive participation in learning activities. Students with frequent access to the Internet resources, who joined in discussion, performed assignments and were eager to grasp their course content showed various patterns of engagement. The research as found by Bond et al (2020) was found to be widely studied and varied in a number of foci on how students engage in learning with educational technology with varying nature and measurement of students engagement. Martin and Bolliger (2018) noted the importance of interactions between LIC-PIC, LIC-LLC and LIC-LCC in an online learning environment. All of these factors led to a need to analyze the relationship between technology use, SRL and student engagement in a cohesive manner. In this study, therefore, the students independent learning ability and participation in learning activities were studied in relation to the use of technology, thereby to build digital education practices that are more aware and purposeful from the learner's perspective.

The information and background of a study. Background of research.

Background of the Study

Digital learning has changed the way that learners have accessed information, interacted with the learning content and dealt with learning tasks. This enabled learning management systems and recorded lectures, online libraries, educational videos and discussion forums, as well as digital assessment tools, to provide opportunities for students to learn at different time and places. The value of these tools in relation to their uses for learning purposes, was contingent upon the uses to which students put them in relation to learning. In a systematic evidence map of the research about educational technology and student engagement, Bond et al. (2020) showed that technology-supported learning included behavioural, emotional, and/or cognitive aspects of engagement. They also identified some of the diversity in the understanding and assessment of engagement by researchers. This evidence suggests, therefore, that besides repeated user rates of platforms, the learning behaviours of students should also be studied in relation to digital infrastructures to find out whether these affected their learning achievements or skips. Al Mamun and Lawrie (2023) talked about the interaction of the students with the content in SRL online learning materials, which underlines the importance of grasping the interaction between students and SRL online learning materials.

The second key concept of the research was the realization of self-regulated learning where students are expected to manage their learning process themselves and do not just rely on the teacher's facilitation. This activity did not only involve establishing goals, programming study plans, engaging, learning styles, monitoring understanding, but also maintaining effort and reflecting upon learning outcomes. Broadbent and Poon (2015) stated that the accumulated literature on the relationships between SRL strategies and students' learning outcomes identified four distinct and related SRL strategies: time management, metacognition, effort regulation and critical thinking. Self-regulation also has been documented in more recent examples – those of online education. Based on online learning context, this study examined relationship between self-regulated learning and anxiety of the university students in online English course, which confirmed that it is important to study the learning style of students and the attitude of students to study in online learning. Researchers in this study were Apridayani et al. (2023). Sun et al. (2023) explored trends in SRL behaviours and their relationships to cognitive load and engagement, through learning analytics.

Student engagement was the next shift and with the introduction of student autonomy as a learning approach, it was more than information or task completion. It also has students who are engaged, listening to and responding to what is being taught, using their working memory and thinking and who are interested in learning. Students' perceptions of engagement strategies used in online learning were explored by Martin and Bolliger (2018) and highlighted the need for engaging in interactions, such as interaction with the instructor, interaction with the content, and interaction with other students. Miao and Ma (2022), in their research on 334 undergraduate students, found that there was a positive correlation between self-regulation and social presence and the engagement in online learning. These researchers found that engagement was relevant to some dimensions of

students' SRL processes and student–student interaction in the online learning environment. Wei et al. (2023) studied the motivation, perceived learning support, student engagement, and self-regulated learning strategies in massive open online courses (MOOCs), and concluded that all the studied constructs are important if one is to examine learning outcomes in MOOCs. The present study aimed at this question by exploring the relation between the students' use of Learning Technology and SRL and engagement, especially in the formation of students' independent Learning Practices.

Research Objectives

- To explore students' self-regulated learning and relationship with technology use in digital learning.
- To explore the connection between SRL and student engagement in digital learning.
- To explore the links between the use of technology, SRL and student engagement in order to understand how digital learning helped to facilitate independent learning processes.

Research Questions

1.How was teacher's technology affect students' SRL in digital learning environment?

2. How was the relationship between students' SRL and the students' involvement in the digital learning activities?

3. What relationship exists between technology use, self-regulated learning and student engagement with the development of independent learning practices among students?

Significance of the Study

Importance of this research was that it has integrated three of the most critical elements of digital education—technology integration, SRL, and students' engagement. This study was not directly directed at understanding technology as a solution in itself to educational problems, but focused on how students used technology as part of their learning strategy and participation in class to manage their learning with regard to their educational obligations. Findings may help teachers to understand how digital tools are supporting their students to plan, use time, monitor their progress, and be active learners. They might also help universities to create digital learning spaces that fosters autonomy and appropriate academic guidance and interaction. The research could give educational technology developers insights into the usefulness of the tools that facilitated the goal setting, monitoring, feedback and reflection on learning. The study could be interesting to add to independent learning study by examining the relationships between some of the above studies in the major education factors of the study. The outputs can also be used as a foundation for studying other educational grades, branch, types of institutions, with students who required additional information and knowledge in the field of good digital learning habits.

Literature Review

Recent research on digital technologies supporting student self-regulated learning (SLL) has increased in interest. Online lectures, learning management systems, digital exercises, feed-back systems and educational applications allowed students to learn when it wasn't defined lecture time. These educational resources could be used by the students, but they did not use them to their educational advantage unless they did so. Based on the results of their systematic review of 121 studies, Faza and Lestari (2025) examined the SRL strategies and the technologies used. Their insights included the importance of LMS, collaborative platforms, AI, and learning analytics to facilitate goal-setting, tracking, and self-study. The authors of Siminga et al. (2025) at the higher education level focused on the relationship between students' online learning interactions and Computer Education use of technology and SRL. The students' skills of engaging with the digital environment were highlighted in this work. This work indicated that consideration of technology use needs to focus upon how students used technology to plan and execute academic tasks and not focus on simply how much technology students used.

The concept of self-regulated learning, which engages students in taking on numerous roles in relation to learning in online and blended settings, has been welcomed with excitement. Should be able to decide own learning time, seek information & feedback, assess learning, seek assistance & support. In terms of SRL strategies in digital context, Faza and Lestari (2025) identified that goal setting, time management, learner self-monitoring, reflecting, and learner help-seeking strategies are important ones. The following strategies are mentioned because they will reduce the likelihood of two students with the same technology implementing them producing different learning outcomes. Heikkinen et al. (2025) performed a longitudinal study of 165 first-year business students to study the correspondence between student engagement and self-regulated learning, using data from LMS and self-reported assessments. They found variations in patterns of regulation and engagement, indicating that students didn't take the same uniform approach to adapting to learning online. By conducting this research, the researcher reconfirmed the significance of self-regulation learning as a continuous process of students' learning behaviours change.

Another topic that has garnered interest in recent educational research is how self-regulated learning is related to student engagement. The student might have the ability to have an extensive digital asset, but while they may not be as motivated to interact with them, or have the time-management skills, they may not be cognizant of the context in which they are learning. The authors of this paper, Xu et al. (2024), investigated the factors including self-regulated learning strategies, self-efficacy and learning engagement of 1,107 university students who learning English in smart classrooms. They concluded that the influence of self-efficacy was the most powerful mediation effect between SRLS and student engagement. This discovery indicated that there might be a connection between the students' self-efficacy to perform academic tasks and the relation between learning strategies and their active involvement. Wolters et al. (2023) assessed a college program to enhance students' learning abilities in another study. The findings showed positive effects in the self-regulation strategies, motivational beliefs and behavioural and emotional engagement. These

investigations demonstrated that engagement was more than simply being physically present or electronically present, it also meant a willingness to participate, to stay in the activity, to put effort in and to devote their focus to learning activities.

The following disregarded issues in current literature were identified as needing further investigation about digital technology, SRL and student engagement. Firstly it was not a universal experience of pupils as; motivation and access to digital tools and resources were different as were the capabilities of pupils to manage independent learning and therefore their pupil digital skills. Wang et al (2025) investigated the relationship between ICT tools and software use with SRL through the lens of ICTs view. Through their research, they identified the different dynamics and processes of various technology uses and their relationships to students' learning regulation. Secondly, the research of the online involvement showed that there were some important factors that gave an impact to the students' involvement such as personal factors, instructional factors, and environmental factors. In a systematic review article, Hu and Xiao (2025) investigated factors related to the engagement of online learning and emphasized the need of taking into account the various influences at play within the digital learning environment. Both student self-regulation and teacher support were used to facilitate the relationship between self regulation and student engagement in online learning in Zambia studied by Kangwa et al. (2024). This study was an attempt to do this need by studying the relationship between these three variables with considering the significance of study variables in building up independent learners.

Research Methodology

Research Design

A quantitative research design approach was used to address the aspects of technology use, SRL, and digital learning engagement. The cross sectional survey approach was chosen because it would enable information to be gathered at one single time. The designs were centered on thinking about students' experiences using digital learning and exploring patterns in students' self-reported technology use, learning strategies, and engagement. There was no experimental intervention or manipulation of learning conditions in the study. Rather, it explored students' personal experiences of digital learning in their learning environments.

Population of the Study

The target population was students participating in university studies who were using digital technologies in academia for academic assignments. These students used learning management systems, online lectures, digital library, online learning websites, electronic assignments and other technology-based resources for learning. The respondents participated in this study were the university students who were selected as they had to look after several things in their academia such as doing independent reading, preparing the assignments, preparing the examination and participating in online learning activities. Their experiences were appropriate to/in their study of the role of technology usage for SRL and engagement. Students on various academic disciplines and

years of study were taken into account to gain a wider picture about the use of digital learning. Participants needed to have adequate experience of using digital tools for education activities in order to be able to give meaningful information to the questionnaire.

Sample Size and Sampling Technique

A total of 300 University students who were using digital technologies for academic learning was proposed as a sample for the study. This sample size was chosen because it is practical for data to be gathered regarding technology use, SRL and student engagement concerning a variety of student experiences. To get the participants, convenience sampling method was used, which means that those who are accessible and willing to take part in the research were recruited. Questionnaire was disseminated by student groups in the universities, academic networks and Internet. Students volunteered to participate and were informed in advance of the purpose of the study when they were asked to fill out this questionnaire. The sample was designed to have students from various disciplines, various study levels and various groups.

Research Instrument

The data were gathered by structuring a questionnaire based on the 3 main variables of the study, namely the use of technology, self-regulated learning, and student engagement. The questionnaire contained four sections: Demographic information, using of digital learning technologies, learning management and academic involvement. The technology-use section contained questions concerning how often people use the digital platforms and online resources of their class; the lectures they hear on video; applications used for education reasons; and electronic learning materials. This section focused on SRL in the form of goal setting, study planning, time management, monitoring progress, managing self efforts, and reflection on learning performance. The student-engagement portion focused on participation in learning activities, paying attention to academic tasks, putting in work in learning tasks, and learning in a digital learning environment. Relevant statements were marked on a 5 point Likert scale ranging from: 1- Strongly Disagree to 5- Strongly Agree.

Data Collection Procedure

Data collection process consisted of questionnaire dissemination to students at universities by Internet. Participants were informed of the purpose of the study, the voluntary nature of student participation and the use of the information collected in the study for academic purposes before responding. The students were clearly informed of the directions to follow the questionnaire and they were encouraged to answer based on their their real-life experiences with digital learning. The questionnaire was constructed in keeping with the requirements of not over-complicating the questions and the time required for all respondents to complete the question. Responses were gathered within the set time of data collection and then organized for the purpose of analysis. Responses were then checked for completeness, for duplications (if these were identified), and for those who were not within the inclusion criteria of the study. All responses that did not meet the

criteria were rejected for analysis. The exact number of participants in the study as well as the days it was conducted should be reported in the completed research report.

Data Analysis

Descriptive statistical techniques were used in analyzing the collected data. Data for the demographic characteristics of participants and their attachment to technology were summarised using frequencies and percentages. Students' reported experiences of digital learning, self-regulated learning and engagement regarding the questionnaire items and scores of the relevant variables were described using both means and standard deviations. Tables and charts were used to provide a clear presentation of results where applicable so findings were easier to interpret. Common trends emerged from the study in terms of digital tools that students identified as their favourites, the learning strategies they reported using, and the learning engagements they experienced in digital learning environments. Group comparisons might also be performed to report variations from one selected group to another if there were adequate observations in each group.

Results and Analysis

Demographic Characteristics of Participants

This section described the demographic characteristics of participants, including gender, age, academic level, and academic discipline.

Table 1. Demographic Characteristics of Participants (N = 300)

Demographic variable	Category	Frequency	Percentage
Gender	Male	138	46.0%
	Female	162	54.0%
Age	18–20 years	105	35.0%
	21–23 years	126	42.0%
	24 years and above	69	23.0%
Academic level	Undergraduate	213	71.0%
	Postgraduate	87	29.0%
Academic discipline	Social sciences and humanities	96	32.0%
	Science and technology	90	30.0%
	Business and management	66	22.0%
	Other disciplines	48	16.0%
Total		300	100.0%

The results showed that the females constitute 54 % of the students and 46 % for males students. The age group of 21-23 years students were the most dominant (42%), while 18-20 years and 24 years and above (23%) were the second largest group. There were 71% undergraduates and 29% postgraduate students. Academic disciplines, Business and Management (22%), Science and

Technology (30%) and Social Science and humanities (32%) came next followed by other disciplines (16%). The distribution suggested students of various academic backgrounds with an overwhelming number of the students being undergraduate students.

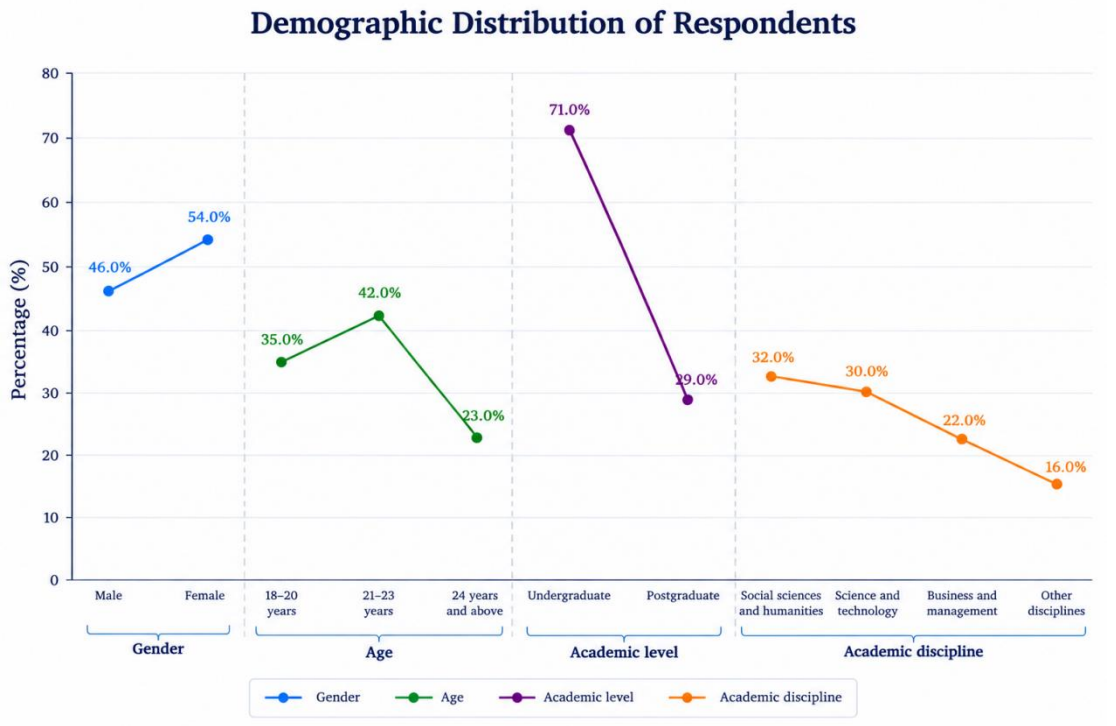


Figure 1. Demographic Characteristics of Participants (N = 300)

Technology Use in Digital Learning

Table 2. Frequency of Technology Use for Academic Learning (N = 300)

Digital learning activity	Frequently	Sometimes	Rarely or never
Learning management systems	174 (58.0%)	90 (30.0%)	36 (12.0%)
Online videos and recorded lectures	189 (63.0%)	81 (27.0%)	30 (10.0%)
Digital libraries and e-books	132 (44.0%)	111 (37.0%)	57 (19.0%)
Educational applications	120 (40.0%)	117 (39.0%)	63 (21.0%)
Artificial intelligence learning tools	96 (32.0%)	105 (35.0%)	99 (33.0%)

The results indicated that online videos and record lectures were the most widely utilized resources, with 63% of students using these frequently, followed by learning management system with 58%. 44% of participants often accessed electronic materials such as digital libraries and e-books; and 40% often accessed educational applications. The frequency of use by students of AI learning tools

was shown to be the least frequent (32% using it frequently, and 33% using it rarely or not at all). This finding implied that students would use more recorded academic content and learning platforms compared to AI based tools. The findings also revealed differences in how students utilized digital resources which might reflect how they considered which technologies were appropriate for their needs and/or interests in learning.

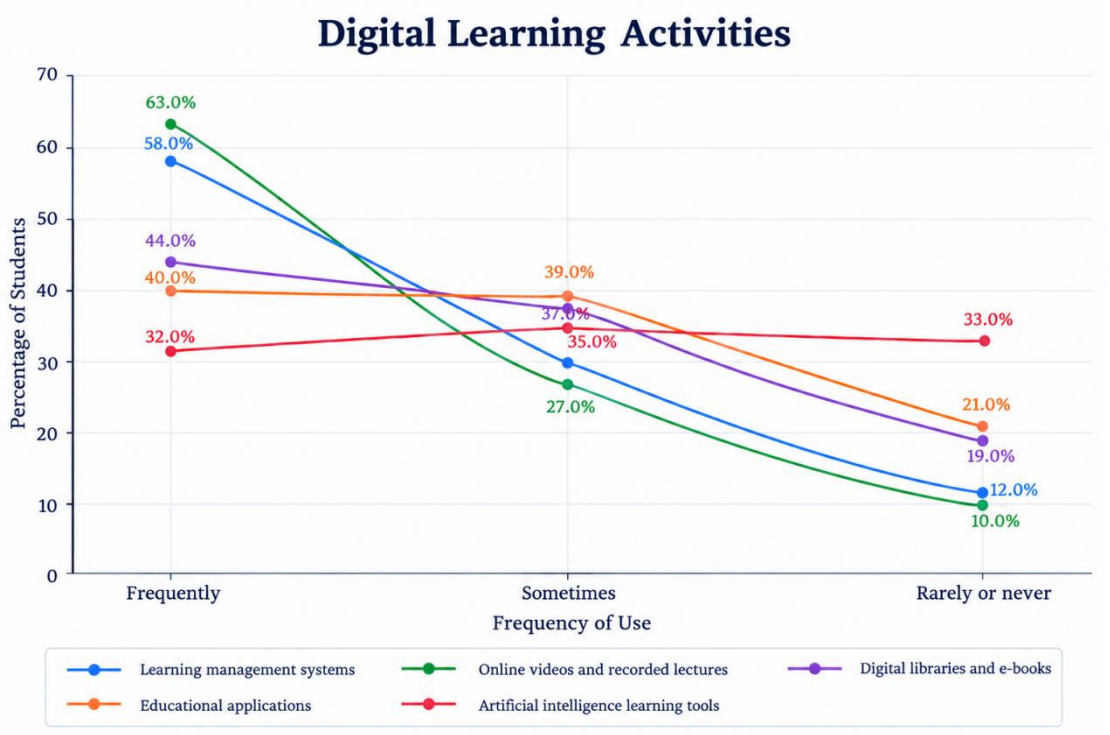


Figure 2. Frequency of Technology Use for Academic Learning (N = 300)

Self-Regulated Learning Practices

Table 3. Descriptive Statistics for Self-Regulated Learning (N = 300)

Self-regulated learning statement	Mean	Standard deviation
I set clear goals for my digital learning activities.	3.71	0.91
I organised my time for online study.	3.48	1.02
I monitored my progress while studying digitally.	3.62	0.94
I remained focused on academic tasks when studying online.	3.39	1.05
I reviewed my learning to identify areas for improvement.	3.67	0.89
Overall mean	3.57	0.96

The overall mean of 3.57 suggested a moderate positive attitude towards SRL practices in general.

The mean scores for goal setting (3.71), reviewing learning for improvement (3.67) and monitoring progress (3.62) were the highest. The mean of the time management was 3.48, and the lowest mean was time spent maintaining concentration (3.39). A wide range of standard deviations from (0.89 to 1.05) shows variation in students' responses. From these results, it was concluded that individuals were using planning and reflection strategies mostly instructed, but for a certain amount of time time management and concentration were found to be comparatively harder. The results showed the need for supporting the students in arranging their study schedule, paying attention, and tracking their academic development for independent digital learning.

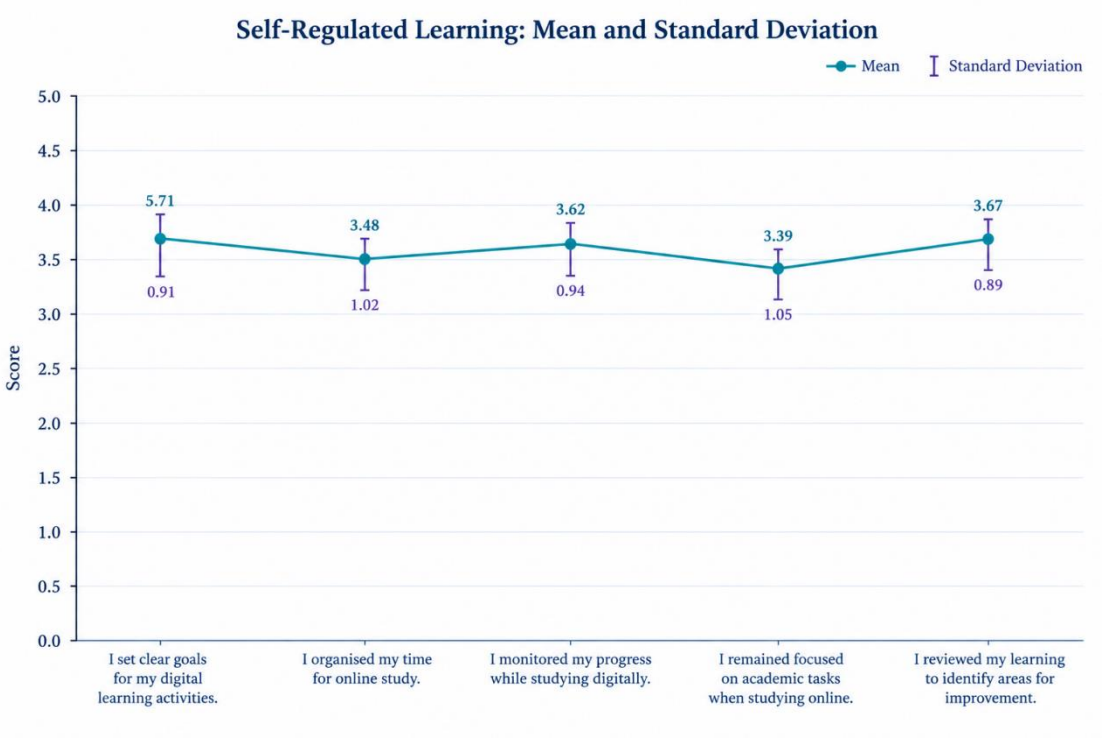


Figure 3. Descriptive Statistics for Self-Regulated Learning (N = 300)

Student Engagement in Digital Learning

This table examined students' engagement through participation, task completion, concentration, interest, and effort in understanding academic concepts.

Table 4. Descriptive Statistics for Student Engagement (N = 300)

Student engagement statement	Mean	Standard deviation
I actively participated in digital learning activities.	3.64	0.93
I completed online academic tasks on time.	3.51	0.98

I concentrated on understanding digital learning materials.	3.58	0.95
I remained interested in my online learning activities.	3.42	1.01
I made an effort to understand difficult academic concepts.	3.73	0.88
Overall mean	3.58	0.95

The average score of 3.58 indicated that students were moderately engaged. Trying hard to understand topics earned the highest average score of 3.73. Next active involvement with the material had an average of 3.64. Paying attention to learning materials had an average of 3.58. Finishing schoolwork on time had an average of 3.51. Keeping interested in learning activities earned an average score of 3.42. Standard deviations ranged from 0.88 to 1.01 showing that students had experiences. These results showed that students usually made an effort with their studies and took part in learning. However staying interested and finishing work on time were harder, for students. The results showed that interactive learning clear deadlines and regular feedback could help students stay engaged.

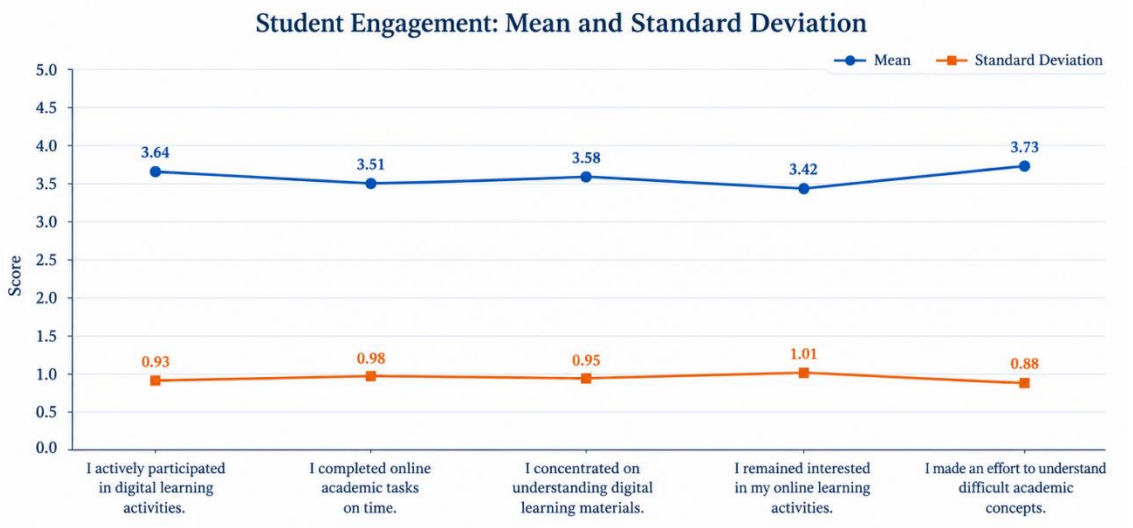


Figure 4. Descriptive Statistics for Student Engagement (N = 300)

Discussion

The results showed that digital technology was used to support the students' learning process, especially recorded lecture, LIS, blogs, etc. The result of using recorded lecture in learning, more than frequently used learning management system as reported by the students result of 63% exceeded by frequently used learning management system of 58% of the students. In this place, the design patterns was shown to students as evidence of a use of digital space for learning materials supporting students' learning that is a self-directed learning. Digital use in Higher Education (HE) context has also received these days some attention from researchers, and has become a relevant issue as well

(Bergdahl et al., 2024). De Bruijn-Smolders and Prinsen (2024) conducted a systematic review which additionally addressed the ways to support student engagement in blended learning environments. The following findings, therefore, need to be read in light of the way learners are engaging with the digital resources, how they organized their learning tasks, and their participation in learning activities. Pupil use of AI learning support has also been proportionately fewer (32%) indicating that pupils use digital learning support in different ways to support their learning.

The result of self-regulated learning with the mean score of 3.57 was found with the highest score in goal setting which was 3.71, while the lowest score obtained was in concentration (3.39). Overall, these findings revealed students reported setting goals when learning, which was generally a more challenging task, compared with paying attention. Online interaction and the students' technology skill has been a topic that has been recently studied in relation to self-regulated learning (SRL) (Hashmi et al., 2025). This study is also similar to Zhou et al. (2025), who explored the influencing factors of online self-regulated learning of university students. Tran and Ma (2024) has also done research on using SRL strategies in SFLT. The two studies combined highlight the need for scaffolding student planning and learning, checking student progress, and reflecting on the student learning needs. The teacher can support these practices by establishing deadlines, offering structured learning activities, offering opportunities for progress monitoring, and giving the advice on what they ought to learn effectively. However, the result of the descriptive analysis in the current study was not statistically showed any relationship between MSL and technology use.

The values of the students' engagement resulted in an average value of 3,58 with the highest value being given to the aspects of effort in the process of grasping concepts that are difficult to learn (M = 3,73) and the lowest value to aspects of consolidating attention (M = 3,42). This trend indicated that students mentioned that they were trying to grasp the material or content presented during a course but there might be some difficulty to maintain interest. Heikkinen et al. (2025) identified engagement and self-regulation as different aspects of the online learning of University students. Further, the present study adopted and examined online student engagement dimensions of self-regulation, teacher support in line with the work done by Kangwa et al. (2024). Xu et al. (2024) investigated the relationship between self-regulated learning strategies, self-efficacy and engagement in smart classrooms with EFL university students as the subjects of their study. Alrashidi and Alshammari's study (2025) also examined the effects of teachers' support, SE and academic emotions on students' online engagement. Furthermore, Oportus-Torres et al. (2024) investigated the concept of SRL and Emergency remotely delivered activities (ERA) among AEDC. The present research did not involve making any statistical connections nor claim any direct causality of the use of the technologies and of engagement.

Conclusion

The researchers found high value from digital technologies for university students to access learning resources, and engage with independent learning activities. There was relatively little use of AI learning tools (32%), when compared with the popular resources such as online videos and recorded lectures (63%). The overall score of self-regulated learning (3.57) and student engagement (3.58)

are both at a moderate level of positive experiences. But these two were comparatively lower-strength areas: concentration (M = 3.39) and maintaining interest (M = 3.42). This is necessary for universities and teachers to encourage the rational application of technology, based on proposed science tasks, as well as, interesting learning activities, timely checking in progress, giving feedback, etc. Additional research is needed to explore the relationships between technology use, SRL and students' involvement using inferential methods, as this is a descriptive study.

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