

The Impact of Employing Digital Platforms on Developing Self-Directed Learning among Learners

أثر توظيف المنصات الرقمية في تنمية التعلم الذاتي لدى المتعلمين
شارك هذا البحث في المؤتمر الدولي المحكم الذي عقد في شهر
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البحث العلمي في مواجهة التحولات المعاصرة
مقاربات منهجية وتطبيقات عملية في إنتاج المعرفة العلمية

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Abstract

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Digital platforms are reshaping university teaching by offering flexible access to content, multiple forms of interaction, and learning spaces that extend beyond the physical classroom. This study investigates the extent to which learning management systems (LMSs), massive open online courses (MOOCs), and interactive digital applications support the growth of self-directed learning (SDL) among university students. In this paper, SDL is understood as the learner's capacity to begin, organize, supervise, and judge learning activities with limited direct assistance. A quasi-experimental field study was conducted with 100 students distributed equally between experimental and control groups. The results show that students who learned through gamified digital platforms recorded clear gains in motivation, self-monitoring, and self-management, and the pre- and post-test differences were statistically significant. The findings indicate that digital environments may strengthen learner autonomy when they provide individual learning routes, immediate feedback, and accessible resources. At the same time, their impact may be restricted by unequal technological access, weak digital competence, and the cognitive burden

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created by excessive information. The study concludes that well-planned and well-supported digital platforms can help learners acquire the independent learning skills needed for lifelong

learning in a digitally mediated educational context.

Keywords: digital platforms, self-directed learning, learner autonomy, online learning, information literacy.

الملخص

ومهارات المراقبة الذاتية والإدارة الذاتية لديهم، مع وجود فروق ذات دلالة إحصائية بين نتائج ما قبل التدخل وما بعده. ويمكن للمنصات الرقمية أن توفر مسارات تعلم مخصصة، وتغذية راجعة فورية، وموارد تعليمية واسعة تعزز استقلالية المتعلم ودافعيته وتنظيمه الذاتي. ومع ذلك، تواجه فاعلية هذه الحلول تحديات تتمثل في الفجوة الرقمية، وضعف الكفايات الرقمية، والعبء الزائد في معالجة المعلومات. وتبين الدراسة أن المنصات الرقمية، عندما تُصمم وتُدعم بصورة مناسبة، يمكن أن تعمل بوصفها أدوات تعليمية فعالة لتنمية كفايات التعلم المستقل المطلوبة للتعلم مدى الحياة في العصر الرقمي.

الكلمات المفتاحية: المنصات الرقمية، التعلم الذاتي، استقلالية المتعلم، التعلم عبر الإنترنت، الثقافة المعلوماتية.

Introduction

Online platforms have become an important part of contemporary teaching and learning in higher education. LMSs and MOOCs are no longer used only to distribute course materials; they also organize

توفر المنصات الرقمية للمؤسسات التعليمية أساليب مبتكرة لتقديم التعليم، تجمع بين المرونة وسهولة الوصول وبيئات تعليمية تفاعلية. تتناول هذه الدراسة كيفية مساهمة أنظمة إدارة التعلم (LMSs)، والمساقات الجماعية المفتوحة عبر الإنترنت (MOOCs)، والأدوات الرقمية التفاعلية في تنمية مهارات التعلم الذاتي لدى المتعلمين ضمن تجارب التعليم عبر الإنترنت. ويُقصد بالتعلم الذاتي قدرة المتعلمين على المبادرة بتعلمهم وتخطيطه ومراقبته وتقويمه بصورة مستقلة، مع الحد الأدنى من التوجيه. وباستخدام تصميم ميداني شبه تجريبي شمل 100 طالب جامعي قُسموا إلى مجموعتين: تجريبية وضابطة، توصلت الدراسة إلى أن استخدام المنصات الرقمية القائمة على التلعيب حسن دافعية المتعلمين

communication, assessment, feedback, and learner participation. By allowing students to work at a suitable pace, review their progress, and interact with digital activities and assessment tools, these platforms create conditions in which learners can participate more

actively in building knowledge within changing educational contexts (Araújo & Carvalho, 2022; Khaldi et al., 2023).

Within this transformation, self-directed learning (SDL) has gained particular importance. SDL requires learners to recognize what they need to learn, formulate goals, locate suitable resources, choose strategies, and judge the quality of their own performance. These responsibilities become more visible in online learning, where the instructor is not always present to guide every step of the learning process. Consequently, digital education encourages a stronger move toward learner-centered practices that value independence, adaptability, and lifelong learning (Morris, 2024; Palaniappan & Noor, 2022).

Research on digital education suggests that learners who use SDL strategies tend to achieve better outcomes and a deeper understanding of course content. The benefit is not limited to the freedom to choose when or how to study; it is also connected to the learner's ability to observe progress, identify weaknesses, and adjust learning behavior. For this reason, self-monitoring is often considered a decisive element of successful independent learning in online environments (Nakiyemba, 2024; Morris, 2024).

LMSs and MOOCs can encourage SDL through open access to materials, opportunities for self-paced study, and reflective functions such as online quizzes, progress indicators, dashboards, and formative feedback. However, these tools do not automatically improve learning. Their value depends on the quality of the platform design and on the learner's readiness to use the system productively. If online environments are poorly organized or offer little guidance, students may experience cognitive overload, lose focus, or become less engaged (Khaldi et al., 2023; Ghory & Ghafory, 2021).

Generation Z students are often familiar with digital technologies and usually adapt quickly to online tools. Nevertheless, familiarity with technology should not be confused with effective learning autonomy. Studies show that many students still face difficulties in maintaining attention, judging the credibility of information, and managing study time, especially when digital courses lack organization and clear direction. This situation highlights the need for programs that combine flexibility with structured guidance and deliberate instructional design (Çoklar & Tatli, 2021; Rue, 2018).

The benefits of digital education may also be limited by unequal

access to devices and internet services, differences in students' digital skills, and problems related to motivation and persistence. These issues indicate that successful SDL in online learning requires more than the introduction of technology. It also requires effective instructional planning, institutional support, and inclusive digital practices that allow all students to benefit from online learning opportunities (Khaldi et al., 2023; Morris, 2024).

Research Objectives and Hypotheses

On the basis of this background, the study was organized around specific objectives and hypotheses that examine the relationship between digital platforms and learners' independence. These objectives and hypotheses correspond to the quasi-experimental design, the three measured SDL dimensions, and the statistical procedures used in the empirical analysis.

Research Objectives

The general purpose of this study is to determine how the use of digital learning platforms contributes to the development of SDL among university learners. The study specifically aims to:

1. measure the effect of digital learning platforms on learners' overall SDL level;
2. assess whether digital platforms improve the main SDL dimensions: motivation, self-monitoring, and self-management;
3. examine how gamification elements, including points, badges, leaderboards, and personalized learning paths, contribute to engagement, autonomy, and learning responsibility;
4. compare the post-intervention SDL performance of learners exposed to gamified digital platforms with that of learners taught through traditional face-to-face instruction;
5. analyze the relationships among motivation, self-monitoring, and self-management after the intervention;
6. identify the implications of digital platforms for strengthening learner autonomy, independent study practices, and lifelong learning in higher education.

Research Hypotheses

In line with the study objectives and the reviewed literature, the following hypotheses were tested:

H1: Learners' overall SDL scores differ significantly between the pre-test and post-test after the use of digital learning platforms.

H2: Digital learning platforms have a statistically significant positive effect on learners' motivation for SDL.

H3: Digital learning platforms have a statistically significant positive effect on learners' self-monitoring skills.

H4: Digital learning platforms have a statistically significant positive effect on learners' self-management skills.

H5: Learners who study through gamified digital platforms obtain higher post-intervention SDL scores than learners who receive traditional face-to-face instruction.

Together, these objectives and hypotheses guide the literature review, the methodological procedures, and the interpretation of the field results.

Theoretical Framework and

Literature Review

Conceptual Foundations of Self-Directed Learning

The study is based on the relationship among SDL, self-regulated learning (SRL), learner autonomy, and digital instructional design. SDL involves the learner's ability to recognize learning needs, set goals, choose resources, regulate strategies, and evaluate outcomes. In online environments, SDL is closely related to SRL because learners must

plan, monitor, reflect on, and modify their learning behavior with less direct instructor control. Recent scholarship links SRL in higher education with goal setting, metacognitive strategies, time management, reflection, help-seeking, and continuous monitoring. Technologies such as LMSs, MOOCs, artificial intelligence, collaborative platforms, and learning analytics can support these processes when they provide useful feedback and personalization (Faza & Lestari, 2025). This understanding is also consistent with Morris's (2024) view of SDL as a meta-competence needed for lifelong learning in changing academic and professional contexts.

Accordingly, digital platforms should not be treated as simple stores of course materials. They are socio-technical learning environments whose design can either encourage or restrict autonomy. LMSs, MOOCs, analytics dashboards, discussion forums, automated quizzes, and adaptive feedback systems give learners opportunities to influence the pace, order, assessment, and reflection processes of their learning. These opportunities become educationally useful only when they are connected to clear pedagogical aims. The central assumption of this study is therefore that digital platforms support

SDL when they help learners move from receiving content passively to planning, monitoring, and evaluating their own learning actively.

Digital Platform Affordances and Learner Autonomy

Empirical studies support the connection between platform design and self-regulation. Elmabaredy and Gencel (2024), for instance, added SRL features to Moodle and used a pre-test/post-test experimental design. Their results favored the students who learned through the SRL-enhanced platform, suggesting that digital platforms are more effective when they include purposeful self-regulation tools rather than merely offering online materials. This evidence supports the rationale of the present study, which tests whether gamification and personalized learning paths improve the SDL dimensions of motivation, self-monitoring, and self-management.

The literature further shows that autonomy in digital learning develops best when it is supported by structure. Chen and Saharuddin (2024) reported that students' SDL in online learning may be weakened by teacher-centered practices, limited monitoring, insufficient knowledge of SDL, inadequate

learning resources, and low-quality online platforms. Their findings imply that independence should not be left entirely to students; it should be cultivated through clear learning models, systematic follow-up, appropriate resources, and an online climate that encourages responsibility and initiative. For this reason, the present study views autonomy and support as complementary elements. Learners need choice and control, but they also need feedback, guidance, and structured opportunities to reflect.

This balance is essential because digital learning can increase the mental effort required from students. Large volumes of information, multiple tools, and frequent online tasks may overload learners who lack digital literacy or self-management skills. Faza and Lestari (2025) identify limited digital resources, technical problems, resistance to change, and insufficient instructor preparation as barriers to SRL. Earlier studies also emphasize the digital divide, unequal internet connectivity, and variation in students' technological competence as obstacles to equitable online learning (Ghory & Ghafory, 2021; Khaldi et al., 2023). Therefore, platforms can support SDL only when access, skills, and instructional scaffolding are addressed together.

Gamification and Motivational Design

A second foundation of this study is motivational design, especially the use of gamification to encourage engagement and persistence. Gamification involves applying game-related elements, such as points, badges, leaderboards, progress indicators, challenges, and rewards, in learning contexts that are not games. These elements can make progress visible, offer quick reinforcement, and encourage students to continue working toward learning goals. Şimşek and Karakuş Yılmaz's (2025) systematic review links gamified online learning with cognitive outcomes as well as affective outcomes such as motivation, participation, and achievement. This supports the assumption that gamification can influence SDL by encouraging learners to start and sustain independent learning behaviors.

The educational value of gamification, however, should not be reduced to competition. Gamified features are most valuable when they strengthen meaningful self-regulation. Ferdiansyah et al. (2025) found that gamification-based LMS interventions improved engagement, motivation, learning outcomes, and SDL behaviors, especially self-management and self-motivation, while technical problems and distractions remained

challenges. This point is important for the present study because it suggests that badges, points, and leaderboards work best when they are embedded in coherent learning pathways that support planning, progress monitoring, and time management. Gamification is therefore treated here as a motivational scaffold, not as a replacement for sound instructional design.

Artificial Intelligence, Learning Analytics, and Adaptive Support

Artificial intelligence and learning analytics have also expanded the possibilities for supporting SDL in digital education. AI-based tools may offer adaptive feedback, recommend learning resources, identify learning patterns, and assist students during planning, performance, and reflection. Lan and Zhou's (2025) review indicates that AI applications, including chatbots, adaptive feedback systems, serious games, and e-textbooks, can support autonomy across SRL processes. They also stress that AI should remain human-centered so that it strengthens learners' agency and self-efficacy rather than creating dependence on automated support. This point reinforces the need for digital platforms that promote independent judgment, reflection, and responsibility.

Learner Characteristics, Social Support, and Context

Learner characteristics affect the way digital platforms influence SDL. Generation Z students are frequently described as comfortable with technology, visually oriented, and responsive to interactive tools. Even so, technological confidence does not automatically lead to strong SDL. Research indicates that these learners may still struggle with concentration, information evaluation, and time management when the learning environment lacks structure (Çoklar & Tatli, 2021; Rue, 2018). The focus on Generation Z in this study is therefore not based on the assumption that these learners already possess advanced SDL skills, but on the fact that digital learning is highly relevant to them and that their autonomy still needs to be supported through purposeful digital experiences.

The social and cultural context of learning is also important. Although SDL emphasizes personal responsibility, autonomy develops within communities that include teachers, peers, institutions, and cultural expectations. Ubuntu and Ubuntu-gogy perspectives stress communal learning, shared responsibility, and collaborative support in educational development (Boboyi, 2024; Omodan

& Diko, 2021). These perspectives are useful because they prevent SDL from being understood as isolated individual work. In online environments, forums, peer activities, collaborative tasks, and instructor presence can provide the social support that helps learners sustain independence. Thus, this study understands SDL as guided autonomy that combines individual responsibility with supportive learning communities.

Analytical Synthesis of the Framework

The literature reviewed above indicates that digital platforms can influence SDL through several related pathways. Platform features such as flexible access, modular content, quizzes, progress tracking, feedback, and analytics can give learners greater control over learning. Motivational elements such as gamification may increase engagement and persistence, while metacognitive supports such as dashboards, self-assessment, and reflective tasks can help learners evaluate their own progress. Contextual conditions, including digital access, learner readiness, instructor support, and emotional climate, determine whether these platform features are actually used effectively. Monazam Tabrizi et al. (2025) similarly show that digital learning platforms support continuity

more strongly when technology is combined with coherent instructional design, interaction, personalized feedback, and affective support.

This synthesis forms the basis for the hypotheses and empirical design of the present study. The study expects gamified digital platforms to improve SDL because they can raise motivation, support self-monitoring, and strengthen self-management. At the same time, the framework recognizes that such outcomes are not automatic. They depend on platform quality, feedback, learners' digital readiness, and the presence of instructional and institutional support. For this reason, the study measures three SDL dimensions - motivation, self-monitoring, and self-management - and compares an experimental group with a traditional learning group in order to evaluate the educational contribution of a structured digital learning environment.

Methodology

A quantitative quasi-experimental design was adopted to investigate the effect of digital learning platforms on students' SDL. The intervention included LMS functions, MOOC-style learning resources, and gamification elements. This design was appropriate because it allowed the researcher to

compare learning outcomes before and after the intervention and to examine differences between an experimental group and a control group under structured educational conditions (Morris, 2024).

The measurement instrument was adapted from established SDL measures, including the Self-Directed Learning Readiness Scale (SDLRS) and the Self-Rating Scale of Self-Directed Learning (SRSSDL). The final instrument assessed three dimensions that are central to SDL in digital contexts: motivation, self-monitoring, and self-management. These dimensions were selected because they represent the learner's willingness to learn independently, ability to follow progress, and capacity to organize learning tasks (Nakiyemba, 2024; Morris, 2024).

Instrument Validity and Reliability

Before the questionnaire was administered, its reliability was examined. Cronbach's alpha was calculated to determine the internal consistency of the items. This coefficient is widely used in educational research to judge whether items within a scale measure the same construct. The results showed strong internal consistency for all SDL dimensions, indicating that the

items were suitable for measuring motivation, self-monitoring, and self-management. The overall alpha value was above the commonly accepted threshold of 0.70, confirming that the instrument was reliable for the planned statistical analyses.

Table 1: Reliability Analysis of the Measurement Instrument Using Cronbach's Alpha

Dimension	Number of Items	Cronbach's Alpha
Motivation	20	0.88
Self-Monitoring	19	0.90
Self-Management	19	0.87
Overall Scale	58	0.91

The values in Table 1 show acceptable to high reliability for the full scale and for each subscale. The overall Cronbach's alpha value of 0.91 indicates that the questionnaire produced consistent measures of SDL. Since the alpha coefficients for motivation, self-monitoring, and self-management all exceeded 0.70, the scale was considered appropriate for subsequent analysis.

The sample included 100 Generation Z university students, a group selected because of its frequent exposure to digital technologies and online learning practices. Participants were divided equally into two groups. The experimental group consisted of 50 students who used digital platforms with gamification features such as points, badges, leaderboards,

and personalized learning paths. The control group also included 50 students, but they received traditional face-to-face instruction without advanced digital tools. This organization made it possible to compare digital and traditional learning approaches in a structured way (Araújo & Carvalho, 2022; del Olmo-Muñoz et al., 2023).

Data were gathered through a five-point Likert scale, where 1 represented rare engagement and 5 represented consistent engagement. This response format was suitable because it converted learners' attitudes and behaviors into numerical scores that could be compared across groups and dimensions (Ghory & Ghafory, 2021).

MATLAB was used to process and analyze the data. The statistical procedures included descriptive statistics, paired-samples t-tests, independent-samples t-tests, and correlation analysis. These procedures were used to examine pre-post development, group differences, and relationships among SDL dimensions. Normality was checked before applying the statistical tests to support the validity of the analysis (Khaldi et al., 2023).

The methodology therefore provided a systematic means of evaluating whether digital platforms contributed to SDL development. By comparing pre-test and post-test

results for both groups, the study assessed the extent to which gamified digital learning improved motivation, self-monitoring, and self-management.

Practical Part (Empirical Analysis)

This section reports the analysis of the field data collected from learners before and after the intervention. The data were coded, organized, analyzed, and visualized with MATLAB. Three figures and three tables summarize the main results. Overall, the experimental group showed greater improvement after using the gamified platform, with SDL scores increasing by approximately 0.5 to 0.7 points across the measured dimensions.

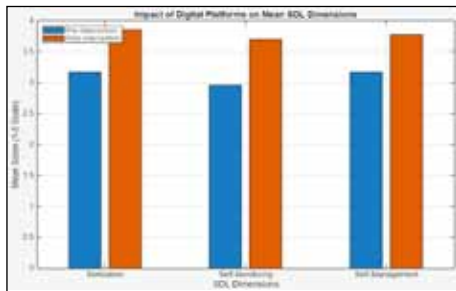


Figure 1: Impact of Digital Platforms on Mean SDL Dimensions

Figure 1 indicates that the mean scores for motivation, self-monitoring, and self-management increased after students used the digital platforms. The strongest increase appeared in self-monitoring, which suggests that feedback mechanisms, progress indicators, and adaptive learning

paths helped learners follow their performance more effectively.

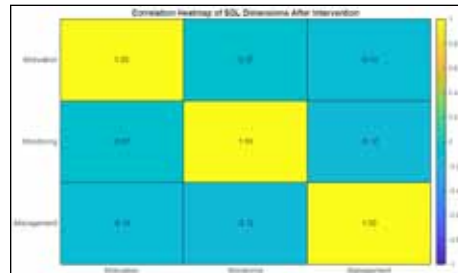


Figure 2: Correlation Heatmap of SDL Dimensions after Intervention

Figure 2 presents the correlations among motivation, monitoring, and management after the intervention. The diagonal values of 1.00 represent each variable's correlation with itself. The remaining values show weak negative correlations: -0.07 between motivation and monitoring, -0.10 between motivation and management, and -0.12 between monitoring and management.

These coefficients show that the three SDL dimensions were not strongly related after the intervention. The slightly negative values indicate only weak inverse associations, meaning that improvement in one dimension did not automatically produce improvement in another. Each dimension therefore appeared to develop in a relatively independent way.

The overall pattern nevertheless confirms that the intervention improved

SDL. Rather than producing one general effect, the intervention appears to have influenced the three dimensions separately. This finding suggests that the digital platform helped strengthen distinct aspects of SDL, while further instructional work may be needed to build stronger connections among motivation, self-monitoring, and self-management.

The heatmap is useful because it shows the internal structure of the SDL variables after the intervention and confirms that post-intervention performance was characterized by improvement with relative independence among dimensions.

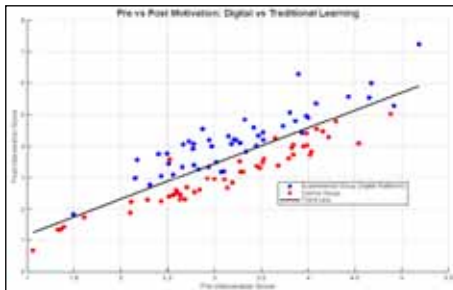


Figure 3: Pre- vs. Post-Motivation: Digital vs. Traditional Learning

The scatter plot shows that students in the experimental group generally obtained higher post-intervention

motivation scores than students in the control group. This pattern suggests that learning through gamified digital platforms was associated with stronger motivation than traditional instruction.

Table 2: Descriptive Statistics of Self-Directed Learning Dimensions Before and After the Intervention

Dimension	Pre-Test Mean $\pm$ SD	Post-Test Mean $\pm$ SD
Motivation	3.21 $\pm$ 0.48	3.88 $\pm$ 0.42
Self-Monitoring	3.02 $\pm$ 0.52	3.79 $\pm$ 0.46
Self-Management	3.14 $\pm$ 0.50	3.71 $\pm$ 0.45

The statistics in Table 2 show that post-test means were higher than pre-test means for all three SDL dimensions. Motivation, self-monitoring, and self-management all improved after the use of digital platforms, indicating growth in learners' ability to direct their own learning. The relatively small standard deviations suggest that the improvement was not limited to a small number of students but was distributed fairly consistently across the sample. These descriptive results provide preliminary support for the usefulness of the digital learning intervention before inferential testing.

Table 3: Paired-Samples t-Test Results for the Self-Directed Learning Dimensions

Dimension	Mean Difference	SD	t	df	p-value
Motivation	0.67	0.45	9.82	49	0.0003
Self-Monitoring	0.77	0.43	11.34	49	0.0001
Self-Management	0.57	0.47	8.41	49	0.0012

Table 3 presents the paired-samples t-test results. The differences between pre-test and post-test scores were statistically significant for motivation, self-monitoring, and self-management, as all p-values were below 0.05. The

null hypothesis was therefore rejected for each dimension. These results indicate that the observed gains were unlikely to be due to chance and support the conclusion that the digital platform contributed positively to learners' SDL.

Table 4: Comparison Between the Experimental and Control Groups After the Intervention

Group	Mean	SD	t	df	p-value
Experimental	4.15	0.39	5.74	98	0.0001
Control	3.45	0.47	-	-	-

Table 4 compares the experimental and control groups after the intervention. The experimental group recorded a higher mean score (4.15) than the control group (3.45), and the independent-samples t-test showed that the difference was statistically significant. This result suggests that the gamified digital learning environment was more effective than traditional face-to-face instruction in supporting SDL outcomes.

Statistical Evaluation

The statistical findings show that the digital platform intervention was associated with significant improvement in all measured SDL dimensions. Both descriptive and inferential analyses point to educational benefits from the intervention. The similarity of the standard deviations and the significant t-values suggest that improvement was relatively

consistent across participants. Overall, the results provide empirical support for using digital platforms to develop learner autonomy and independent learning skills.

Discussion

The findings of this study show that digital learning platforms can strengthen SDL when they are embedded in an instructional environment that gives learners autonomy, feedback, and opportunities for active engagement. The results also show that the value of digital platforms extends beyond their role as repositories of learning content. When designed appropriately, they become interactive environments in which learners can set goals, monitor progress, regulate learning activities, and maintain motivation. This interpretation is consistent with studies that describe SDL as a multidimensional competence

involving motivational, metacognitive, and behavioral elements (Morris, 2024; Chen & Saharuddin, 2024).

The significant rise in overall SDL scores indicates that the intervention improved learners' ability to manage their own learning. Growth across motivation, self-monitoring, and self-management suggests that the platform supported broad learner development rather than a narrow academic outcome. This point is particularly relevant in higher education, where students are expected to develop independence, critical thinking, and lifelong learning habits. Universities can therefore benefit from integrating digital learning environments into teaching strategies when the aim is to enhance learner autonomy.

Motivation improved clearly after the intervention. Students who used gamified digital environments reported stronger motivational outcomes than those taught through traditional instruction. Features such as badges, leaderboards, personalized learning paths, and immediate feedback may have encouraged participation and persistence. The benefit of gamification should not be understood as a simple reward effect; rather, these elements can make progress visible and provide continuous feedback during learning. This result supports earlier studies on

the role of gamification in improving engagement and academic persistence (Khaldi et al., 2023; Şimşek & Karakuş Yılmaz, 2025).

Self-monitoring showed the greatest gain among the three dimensions. Online quizzes, analytics dashboards, and instant feedback enabled learners to observe their performance and identify areas that needed improvement more quickly than in a traditional setting. This finding indicates that SDL requires not only learner independence but also regular opportunities for reflection and evaluation through well-designed digital tools (Lan & Zhou, 2025; Monazam Tabrizi et al., 2025).

Self-management also improved, although the increase was more moderate. This suggests that organizing time, planning tasks, and maintaining consistent study habits may require longer practice, institutional support, and repeated exposure to digital tools. Calendars, reminders, and structured learning paths can support self-management, but instructor guidance remains important, especially during the early stages of developing independent learning habits. These findings are compatible with research showing that autonomy develops most effectively when learners receive appropriate support (Araújo & Carvalho, 2022; Morris, 2024).

The weak correlations among motivation, self-monitoring, and self-management confirm that SDL is not a single uniform skill. Its components may develop at different rates and through different mechanisms. The higher performance of the experimental group also suggests that improvement was related to the pedagogical structure of the platform rather than to technology alone. Immediate feedback, personalized learning paths, and active learner participation appear to have created conditions that supported the development of SDL.

These results must be interpreted alongside the challenges associated with digital education. The success of digital platforms depends on reliable infrastructure, equitable access, digital literacy, institutional support, and clear course organization. Learners may benefit less from a platform when it is difficult to navigate, when information is excessive, or when the learning environment increases cognitive load without providing sufficient guidance.

Overall, the study offers empirical evidence that digital learning platforms can foster SDL when they are integrated into pedagogically coherent environments. Motivation and self-monitoring improved strongly, while self-management appears to require more sustained development.

Universities should therefore combine digital technologies with clear instructional design, continuous feedback, faculty preparation, and learner support in order to maximize the contribution of digital platforms to long-term learner autonomy.

Conclusion

This study concludes that digital platforms produce their strongest educational value when they are supported by thoughtful design, prepared instructors, and coherent instructional strategies. LMSs and gamified environments can encourage learner independence by giving students more control over learning activities, progress monitoring, and academic engagement (Khaldi et al., 2023; Morris, 2024).

The platforms examined in this study can also help students build digital-age competencies needed for lifelong learning, including adaptability, critical thinking, information evaluation, and independent decision-making. Effective implementation, however, depends on attention to three essential conditions: digital accessibility, learner readiness, and structured pedagogical support. Institutions should therefore connect technological innovation with sound educational practice to achieve stronger learning outcomes (Nakiyemba, 2024).

Future studies should investigate whether the positive effects of digital learning platforms on SDL continue over longer periods. Further research is also needed on culturally responsive models that address the needs of different

learner groups. In developing contexts, researchers should examine how gamification and emerging AI-supported tools can be used to improve digital education while supporting sustainable and equitable learning development.

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