

The Impact of Decentralized Learning Platforms on Learner Retention through Digital Credential Trust and Self-regulated Learning Capacity in Emerging Education Systems

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ABSTRACT

This paper discusses how decentralized learning platforms (DLP) affect learner retention (LR) with reference to the mediating effects of digital credential trust (DCT) and self-regulated learning capacity (SRLC) within the education systems in Jordan. The quantitative approach was taken based on the survey data gathered amongst 318 learners that participated in the digital and DLP within Jordan. The hypothesized relationships were tested using structural equation modeling (SEM) with AMOS v.26. The results show that DCP do not exert a considerable direct influence on LR. Nevertheless, they have great impacts on DCT and SRLC that in their turn positively influence LR. These findings affirm the complete mediating effect of the two constructs, and their significance in maintaining learner engagement. The cross-sectional nature of the study and the use of self-reported data are limitations of the study. However, it provides a contribution to the adaptive learning ecosystem literature by implementing the mechanisms of trust and self-regulation into the context of decentralized education. This study offers new knowledge to the connection between DLP indirectly increase the retention of learners in a developing education system because of the trust in digital credentials and the self-regulatory ability of learners in a growing education system

Keywords: Decentralized Learning Platforms, Learner Retention, Digital Credential Trust, Self-regulated Learning Capacity

JEL Classifications: I2, P46

1. INTRODUCTION

The accelerated development of digital technologies has fundamentally changed education into a dynamic, interdependent ecosystem with adaptability, personalization, and decentralization. As part of this transformation, DLP, which is frequently powered by blockchain and distributed architectures, have become a disruptive technology that disrupts the traditional, institution-centric model of education (Alwakid and Dahri, 2026; Chimere et al., 2025). They enable peer-to-peer exchange of knowledge, verifiable digital credentials, and learner-driven pathways, which is in line with the principles of adaptive learning ecosystems that emphasize flexibility, autonomy, and continuous feedback

(Han et al., 2025; Duarte et al., 2025). Nonetheless, even as such platforms continue to gain prominence, a critical question remains; how do such platforms sustain LR, especially in the emerging education systems where institutional trust and technology readiness continue to evolve?

As of 2024, the faster-growing EdTech sector has reached an unprecedented USD 340 billion in market value, which is expected to exceed USD 600 billion by 2030 (Kuo et al., 2023). Digital education adoption in the Middle East and especially in Jordan is speeding up due to changes in policies, demographics of young people, and the increase of internet penetration which has risen to over 89% in the recent years (Gómez Vieites et al.,

2025). In addition, the emergence of micro-credentials and other systems of certification can also be attributed to the shift toward skills-based learning, with more than 70% of employers noting an increasing acceptance of digital credentials (Zira, 2024). Even with such advances, the rates of learner dropouts in both online and decentralized platforms continue to be significantly high, often reaching 40-60%, indicating inefficiencies in engagement and retention (Qingyi, 2024; Ali et al., 2021). It is these trends that highlight the urgency of studying the underlying processes that can affect continued engagement in decentralized learning settings. In this regard, DLP are conceptualized as ecosystems based on technology that spreads control over content, assessment, and credentialing across networks instead of central authorities (Ul Haq et al., 2026; Deckker et al., 2025).

Although these platforms are transparent and flexible, it is the perceptions of legitimacy and value that determine the effectiveness of these platforms. This leads to the role of DCT, which can be explained as the confidence of the learners in the authenticity, recognition, and usefulness of digitally issued certifications (Scholapurapu, 2025; Nguyen, 2025). Lacking confidence in such credentials, learners might not see much payoff on their time and effort investment, and thus the probability of further engagement may decrease. Therefore, the DCT is an important psychological and institutional interface between technological innovation and learner behavior. At the same time, SRLC the capacity of online and autonomous learning students to plan, monitor, and control their cognitive and motivational activities has been long-established as an important determinant of success in online and autonomous learning environments (Bao and Liang, 2025). Learners need to rely on self-regulation to follow learning paths and persist in their learning (Alzahrani et al., 2021). Thus, the incorporation of SRLC into this research offers a behavioral-cognitive framework of how learners adjust to the decentralized systems. Lastly, LR is described as the sustained involvement and further engagement of learners in a learning platform over time, is a key indicator of the effectiveness of education and the sustainability of systems (Chimere et al., 2025; Kalita et al., 2025). Although these constructs are relevant, past studies suffer a number of shortcomings. Research on retention of online learning has mainly concentrated on centralized systems like MOOCs, often overlooking decentralized systems (Alserhan et al., 2023; Hammami and Alomair, 2026). Although the concept of trust has been studied in e-learning settings, it has mostly focused on the institutional/instructor trust and not DCT (Lexman et al., 2024; Salah et al., 2026).

Current studies on self-regulated learning focus on academic performance but scarcely discuss its mediating nature within the ecology of technology usage (Khaldi and Khaldi, 2025; Zira, 2024). There is a significant number of studies that use isolated frameworks, which do not combine technological, psychological, and ecosystem-level variables into a single model (Han et al., 2025). Moreover, the empirical evidence in developing countries and especially in the Middle East is still very limited, leaving an information vacuum about how a decentralized learning process works in different socio-economic settings (Qingyi, 2024; Duarte et al., 2025). These gaps filled in the current study as the authors

aim to accomplish the following objectives: (1) To examine how DLP directly affects LE; (2) To analyze the impact of DLP on DCT and SRLC; (3) To investigate how these mediators directly affect LR; and (4) To evaluate the mediating roles of DCT and SRLC within an integrated framework. In such a way the study can be related to the interdisciplinary and ecosystem-oriented approach of adaptive learning research.

The importance of the given study is complex. In theory, it contributes to the body of knowledge by incorporating the trust theory and SRL theory in the context of decentralized education systems, which provides a holistic view of the learner behavior. In practice, it gives practical information to policy makers, platform developers, and educational institutions to develop more trustful and learner-centered systems. Contextually, a thrust on Jordan makes the findings more relevant in the development of the countries that are undergoing digital transformation in the education sector. It is reasonable to select this sector due to its high rate of growth, significance to the society, and importance to developing competencies in the future workforce. This study (along with other studies) is one of the first studies to empirically examine the underlying mechanisms by which DLP influence LR, with a particular focus on both cognitive (self-regulation) and institutional (trust) levels. It adds to the emergent body of research on the adaptive learning ecosystem by showing how decentralized technologies can be successfully coordinated with the human-centered learning process. In conclusion, the study provides a new, integrative model that bridge technological innovation with educational sustainability as they are important in the future of education.

2. THEORETICAL BACKGROUND

This research based on two complementary theories to explain how DLP shape LR using DCT and SRLC. The combination of the two theories is deliberate: ALET is what captures the system-level processes of distributed, technology-rich learning environments, whereas SRL theory explains the processes that go on at the individual level that transforms the aforementioned processes into sustained engagement and persistence. The concept of ALET views education as a complex and adaptive system where learners, technologies, credentials, and institutions are co-evolving in their continuous feedback and data-driven adaptation (Siemens, 2005; Downes, 2012). DLP: Distributed architectures make this logic possible, redistributing the control of content, assessment, and certification, which increases flexibility, interoperability, and learner agency (Alwakid and Dahri, 2026; Chimere et al., 2025). According to previous studies, adaptive ecosystems are known to increase personalization and responsiveness, which are linked to a higher level of engagement and persistence (Gupta and Heggond, 2026; Kalita et al., 2025). Nonetheless, ALET also suggests that benefits of systems are not automatic; the results of the process depend on the manner in which learners assess signals within the ecosystem- and in particular the credibility of credentials and the coherence of learning pathways (Ul Haq et al., 2026; Saadati et al., 2023). This is why ALET an appropriate overarching framework to tie together decentralized platforms to LR and foreshadow the role of mediating processes. In this ecosystem, DCT comes

into the limelight as a key interpretive process. Trust, though not considered as a separate theory in this context, is part of ALET as a system reliability and transparency property. In the context of decentralization, students assess the authenticity, recognition, and utility of the credentials that are no longer issued by the traditional institutions alone (Deckker et al., 2025; Kuo et al., 2023).

Empirical research proves that the perceived credibility and transparency of digital credentials play a significant role in influencing the perceived value, and further engagement in online learning (Zira, 2024; Qingyi, 2024). Assuming learners have confidence in the validity of credentials that are recognized by employers and institutions, learners are more likely to continue with it, thus enhancing retention results (Hammami and Alomair, 2026; Khaldi and Khaldi, 2025). Therefore, in ALET, DCT is a system-to-user translation system, transforming technological affordances to meaningful learner outcomes. This paper makes use of SRL in order to explain how learners behave in such settings. SRL assumes that learners consciously control their cognition, motivation, and behavior by means of processes like setting of goals, self-monitoring, and strategic adaptation (Duarte et al., 2025; Ali et al., 2021). These features are especially crucial in decentralized systems, where the external structure is diminished and learners have to work through flexible and often non-linear learning routes (Han et al., 2025; Scholapurapu, 2025). There is an extensive amount of evidence that supports the idea that SRL is a powerful predictor of persistence and completion in online and technology-mediated education (Gómez Vieites et al., 2025; Alzahrani et al., 2021).

Some more recent studies go further with this observation and demonstrate that more advanced digital environments increase the significance of SRL, as learners are required to make sense of feedback, time management, and motivation without constant instructor cues (Nguyen, 2025; Msweli, 2026). Notably, SRL also offers the pathway of behavior on which a decentralized system exerts its effects on retention. Real-time analytics, personalized recommendations, and adaptable pacing are provided by adaptive and decentralized platforms and can be used to help learners increase their self-regulatory capacity (Salah et al., 2026; Bao and Liang, 2025). Empirical evidence shows that students who use such features have a greater level of metacognitive awareness and perseverance (Gómez Vieites et al., 2025). Thus, SRL theory: the platform affordances are converted into sustained engagement, making SRLC a key mediator between decentralized learning environments and LR. When ALET and SRL are combined, it forms a logical multi-level description of the model proposed. ALET describes how decentralized platforms reorganize the learning ecosystem and produce signals of value and credibility (e.g., digital credentials), whereas SRL describes how learners internalize these signals and regulate their behaviors as a result. This relationship is supported by previous integrative research that has shown that ecosystem-level characteristics (e.g. personalization and transparency) affect individual learning strategies and outcomes (Khaldi and Khaldi, 2025; Gupta and Heggond, 2026). Additionally, studies are increasingly demanding models that would bridge the gap between technological systems and human learning processes to understand better the idea of

retention in digital education (Alserhan et al., 2023). Overall, the joint implementation of ALET and SRL will offer a solid theoretical basis of the study. Not only does it justify the inclusion of DLP, DCT, and SRLC but it also explains how the three are interdependent in an adaptive, future-focused system of education. This composite view helps better understand the joint effect of technological innovation and learner agency to influence retention in new education ecosystems.

2.1. Decentralized Learning Platforms and Learner Retention

DLP is a structural change in the nature of educational value creation and reproduction, where a centralized authority is replaced by distributed, learner-centered systems. In these settings, retention is an important outcome of the learning process, indicating not just the persistence of the learning process but also the relevance and flexibility of the learning ecosystem. These platforms facilitate flexible routes, modular access to content, and peer-to-peer interaction which minimises institutional rigidity and allows learners to align educational engagement with personal and professional goals (Langa et al., 2025; Nguyen, 2025). This is especially important in the emerging education systems, where traditional barriers to access and continuity often limit long-term participation (Han et al., 2025). Empirical research indicates that technologically rich and decentralized environments provide more autonomy and perceived control to learners, which are strongly correlated with persistence and lower dropout intentions (Duarte et al., 2025). In addition, decentralized designs also enable open monitoring of learning progress and credential acquisition which can strengthen the sense of achievement, continuity among learners (Hammami and Alomair, 2026). These environments also facilitate the sustenance of engagement by providing adaptive interfaces and real-time feedback loops so that learners can be actively connected to the learning process (Ul Haq et al., 2026). In systems terms, the decentralized platforms create an ecosystem where learning is not limited by the institutional boundaries but is embedded in a wider network of knowledge exchange and validation. Such interconnectedness increases the perceived value of participation among the learners and consequently leads to an increase in the commitment of the learners in terms of continued participation (Zira, 2024; Gupta and Heggond, 2026). In turn, the structural and experiential benefits of DLP are bound to be critical in terms of the maintenance of LR in the changing educational environments.

- H_1 : DLP have a positive impact on LR.

2.2. Decentralized Learning Platforms and Digital Credential Trust

DLP has changed the approach to issuing, verifying, and recognizing educational credentials, moving the power of control over the issuance of educational credentials to distributed digital infrastructures. The perceived credibility of credentials in such settings becomes a determinant factor that defines the perceptions of value and legitimacy by the learners. Decentralized platforms, in contrast to traditional certification systems, can often be built on the principle of verification with the help of blockchain, which contributes to a greater level of transparency, immutability, and traceability of academic achievements (Alwakid and Dahri, 2026;

Bao and Liang, 2025). These technological capabilities minimize the risk of credential fraud and enhance trust in the authenticity of learning outcomes and hence, influence how learners judge the value of their participation (Kalita et al., 2025). Previous research suggests that as soon as the learners start believing that the digital credentials demonstrate credibility and are widely accepted, their trust in the system grows significantly, which once, in its turn, reinforces the positive attitude to the platform itself (Han et al., 2025; Scholapurapu, 2025). This is not just a technical trust but also an institutional trust since learners would tie verifiable credentials to future opportunities of employability and career advancement (Chimere et al., 2025). In a new system of education, where the institutional credibility of the system can be broken, such digitally verifiable credentials can serve as a substitute mechanism that increases the overall system credibility (Alzahrani et al., 2021). Moreover, decentralized platforms allow learners to have more ownership of their credentials, enabling them to store, share, and validate achievements across multiple contexts without relying on a single authority (Deckker et al., 2025). This empowerment enhances the perception of learners that their efforts are safely proudly acknowledged and transferable, which in turn strengthens the trust in digital credentials. Therefore, the structural aspects of decentralized learning environments are likely to be instrumental in promoting the high level of DCT in the context of the transformative educational ecosystems.

- H_2 : DLP have a positive impact on DCT.

2.3. Digital Credential Trust and Learner Retention

The perceived validity of credentials within digitally mediated education systems can be described as a decisive factor in keeping the learners continuously engaged over time. The more the learners get to be assured that their successes are valid, verifiable and appreciated by external stakeholders, the more likely they would be to stick with the learning process. This is perceived not just technically assured, but also socially and economically recognized, especially in situations where other forms of credentials are increasingly complementary or substitutive of traditional qualifications (Duarte et al., 2025; Gomez et al., 2025). Consequently, the belief in digital credentials a prominent psychological factor that contributes to the persistence and decreased dropout rates. Empirical studies are always keen to point out that perceived value and recognition of learning outcomes are strongly related to the continuity of participation in the online and flexible learning environments (Hammami and Alomair, 2026). Learners express increased motivation levels and longer-term commitment when they believe that their credentials are beneficial in terms of improving employability or academic progression (Salah et al., 2026). Further, plausible credentialing systems are indicative of quality assurance, which enhances the confidence of learners in the integrity of the platform and its results (Khaldi and Khaldi, 2025). This confidence breeds in the learners the willingness to put in a long term effort because the returns they expect are worth the effort they are willing to put into the game. Digital credentialing that is trusted in emerging education systems, where uncertainty regarding the recognition of qualifications can be a destabilizing factor, can serve as a stabilizing mechanism allowing the alignment of learning efforts with the tangible future

benefits (Zira, 2024). Moreover, the perceived usefulness of such credentials is enhanced by their visibility and portability across digital ecosystems, supporting the willingness of learners to persist (Ali et al., 2021). As a consequence, the strong development of DCT is likely to considerably enhance LR in the decentralized and adaptive learning settings.

- H_3 : DCT has a positive impact on LR.

2.4. Decentralized Learning Platforms and Self-regulated Learning Capacity

DLP essentially transform the ways in which learners engage with learning materials by restructuring control over learning around the learner instead of a centralized institution. In systems of this type, the control of the cognitive processes of learners by themselves becomes all the more significant, since the instructional control is often restricted. In this environment, learners are expected to actively plan, monitor, and control their learning activities to make sustained academic progress and meaningful outcomes (Gupta and Heggond, 2026; Alserhan et al., 2023). The literature on digital education continuously highlights the fact that the autonomous learning environment requires an increased level of cognitive and motivational control as compared to the traditional classroom setting (Ul Haq et al., 2026). Learners are obliged to set their goals and manage time and assess the level of understanding independently, which directly affects their persistence in learning activities (Bao and Liang, 2025). These requirements are even more enhanced in technology-rich settings, such as decentralized platforms (Saadati et al., 2023). Empirical evidence also indicates that digital learning systems that incorporate adaptive features, i.e. personalized feedback, progress tracking and modular content delivery, can significantly increase the ability of learners to regulate their own learning processes (Alwakid and Dahri, 2026; Gomez et al., 2025). These functionalities promote metacognitive awareness, allowing students to change strategies in real-time, depending on the performance indicators (Chimere et al., 2025). Moreover, research shows that learners who possess higher levels of self-regulatory skills are more persistent and less likely to drop out in both online and blended learning settings (Han et al., 2025; Qingyi, 2024). Self-regulation becomes even more important in emerging education systems when institutional guidance is likely to be inconsistent, which is likely to maintain engagement and progression. Accordingly, the emergence of DLP likely to have a significant positive impact on the development of the SRLC of learners in response to the creation of autonomy, adaptability, and the strategic learning behavior of learners in the dynamic digital ecosystem.

- H_4 : DLP have a significant positive impact on SRLC.

2.5. Self-regulated Learning Capacity and Learner Retention

Internal motivational and cognitive processes are increasingly defining the phenomenon of learner perseverance in digitally mediated learning environments in terms of the effectiveness with which individuals can sustain engagement over time. In DLP, where instructional control is decentralized and pathways of learning are flexible, the function of individual agency comes

into the limelight in determining educational success. In these circumstances, the learners who proactively control their learning activities are more likely to display the increased commitment rates and the persistence rates (Alzahrani et al., 2021; Duarte et al., 2025). Academic continuity and achievement are strong predictors of self-regulatory processes, which are further highlighted by extensive research in educational psychology (Nguyen, 2025). These processes allow learners to be focused and adapt to challenges without the need to have external supervision, especially in technology-driven environments (Hammami and Alomair, 2026). Research also indicates that students who successfully manage their cognition and motivation are better able to stay engaged with online courses and continue their coursework through complicated learning activities (Kalita et al., 2025; Meylani, 2024). System functions in adaptive digital ecosystems (real-time feedback, personalized learning paths, and progress visualization based on analytics) also contribute to enabling learners to control their learning behavior (Scholapurapu, 2025). These characteristics facilitate the development of metacognition as they allow learners to constantly evaluate and re-evaluate their strategies depending on the results of the performance (Deckker et al., 2025). Furthermore, empirical research has shown that the improved ability to engage in self-regulation is closely linked to the increased persistence and decreased dropout intentions in online learning settings (Salah et al., 2026; Lexman et al., 2024). In less developed education systems, where students tend to follow less formal academic courses, self-directed learning becomes an essential factor of continued participation. Thus, greater self-regulatory capacity is likely to have a significant positive impact on the capacity of learners to persist in decentralized and flexible learning systems.

- H_3 : SRLC has a significant positive impact on LR.

2.6. Mediating Role of Digital Credential Trust

DLP exist in complex adaptive educational ecosystems that consist of technological infrastructure, learner agency, and credentialing mechanisms that interact to create educational outcomes. DCT becomes an important interpretive mechanism that transforms system-level characteristics into long-term learner behavior (Bao and Liang, 2025). Once learners begin to feel confident that their outcomes are safely stored, verifiable and socially recognized, they start to feel more confident about the learning ecosystem and become more consistent in their engagement patterns (Zira, 2024). In digital education studies, the importance of trust in technological systems has been noted to play a key role in user continuance behavior, especially in the context of reduced institutional control (Nguyen, 2025). Trust in decentralized environments, where power is shared and validation is mediated through technology, changes to trust system transparency, security, and credibility of digital artifacts (Ali et al., 2021). Empirical research also supports the idea that the perceived trustworthiness of digital credentials increases the willingness of the users to continue with the online learning systems (Lexman et al., 2024; Msweli, 2026). The concept of trust has been continuously regarded as a determining factor of engagement and continuity of behavior in online settings (Khaldi and Khaldi, 2025). When they are convinced that their input is leading to valuable, transferable credentials that valued outside

of the platform itself, learners are more likely to remain active (Langseth et al., 2024). Moreover, credentialing systems enabled by blockchain improve transparency and decrease uncertainty, which strengthens confidence in the results of the credentialing system (Gupta and Heggond, 2026). DCR in emerging education systems, where institutional recognition might be inconsistent, DCT serves a stabilizing role by giving learners the assurance of the legitimacy and future usefulness of their achievements. In its turn, enhanced DCT is likely to be converted into more long-term engagement in the learning environment that is decentralized.

- H_6 : DCT mediates the relationship between DLP and LR.

2.7. Mediating Role of Self-regulated Learning Capacity

It is not the technological access or content availability of a system that determines learner persistence in a decentralized learning environment, but rather the psychological and behavioral processes that mediate between system characteristics and learner persistence. SRLC is one of the most important mechanisms in this regard that captures the capacity of the learner to self-regulate cognitive strategies, motivation, and behavioral control during the learning process. This ability is vital in flexible and autonomous systems that need continuity and overcoming obstacles related to the lack of an instructor (Han et al., 2025; Duarte et al., 2025). A large body of educational research indicates that self-regulation is a powerful predictor of academic persistence, especially in online and technology-mediated learning contexts (Alserhan et al., 2023). Students with the ability to set and monitor goals and strategies are more likely to stay engaged during long periods of learning (Chimere et al., 2025). This effect is further amplified in systems of decentralization where there are no stiff instructional scaffolding and the increased need to provide the learner with autonomy (Ul Haq et al., 2026). Empirical research also suggests that adaptive learning environments are beneficial in terms of stimulating self-regulatory processes through real-time feedback, customized learning pathways, and performance analytics that facilitate metacognitive awareness (Langseth et al., 2024; Nguyen, 2025). Such system capabilities allow learners to constantly assess their progress and adjust the learning strategies accordingly, reinforcing persistence behaviors (Gómez Vieites et al., 2025). Moreover, it is also confirmed by research that the higher the level of self-regulation, the higher the completion rates and the lower the dropout intentions in digital education systems (Kuo et al., 2023). With institutional advice possibly being less than optimal in emerging education settings, SRLC is an important internal motivational force that maintains learner engagement. Thus, the greater self-regulatory skill is supposed to be converted into increased retention in DLP to maintain continuity in adaptive and learner-centred educational ecosystems. Conceptual model is presented in Figure 1.

- H_7 : SRLC mediates the relationship between DLP and LR.

3. METHODOLOGY AND DATA

3.1. Sample and Data Collection

This study used a quantitative approach to analyze the hypothesized relationships shown in Figure 1. The sampling

method was the convenience method of data collection. The survey was developed on Google Forms and shared on different digital learning and professional networking platforms, such as WhatsApp, LinkedIn, Gmail, Facebook, and Instagram. Those individuals who participated in the survey were invited to participate in the survey. Section A of the questionnaire was used to obtain the information about the learning platforms and digital environments which learners were best familiarized with and used on the most. Section B consisted of the items that referred to the four main constructs that are studied in the present research: DLP, DCT, SRLC, and LR, which were located in several existing studies. The introduction letter instructed on the way of filling in the survey, but it was made clear that it is voluntary and anonymous. There were no correct or incorrect answers. All the 338 completed questionnaires were received and after screening, 318 were considered as valid to analyze.

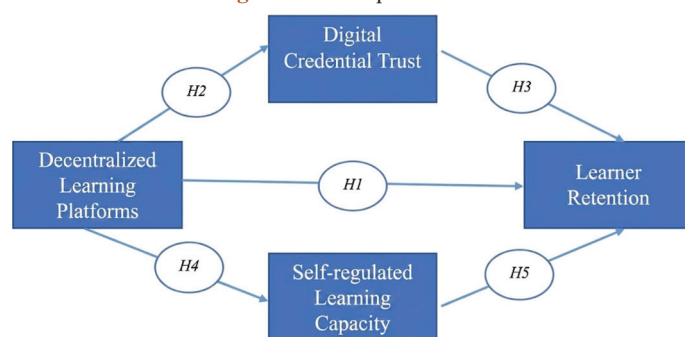
3.2. Measures

This study questionnaire was comprised of four measures: DLP, DCT, SRLC, and LR. Construct validity of DLP was measured using five items borrowed by Mohanraj (2024) and (Alzahrani et al., 2021). One such object is: The learning platform enables me to control and manage my learning activities independently. The coefficient of reliability Cronbachs alpha = 0.94. The construct DCT was measured using six items which were adapted to Bao and Liang, (2025) and (Han et al., 2025). An example question: I think that the digital certificates that are issued by this platform are authentic and trustworthy. The coefficient of reliability Cronbachs alpha was = 0.91. Construct of SRLC was measured in terms of four items which are borrowed in Lexman et al. (2024) and (Bao and Liang, 2025). One such sample question is: I am able to successfully maintain my learning objectives and progress independently. The coefficient of reliability Cronbach alpha = 0.93. Six items that were adapted according to (Meylani, 2024) and (Hammami and Alomair, 2026) were used to measure LR construct. An example item: I am planning to use this learning platform in my upcoming learning activities. The coefficient of reliability Cronbachs alpha = 0.92. A five-point Likert scale was used to evaluate all the constructs. In terms of decentralized learning ecosystems, 11 prominent platforms and online learning environments have been taken into account, such as Coursera, edX, Udemy, Khan Academy, FutureLearn, Linked In Learning, Google Classroom, Moodle-based systems, Blackboard Learn, Canvas LMS, and blockchain-based credential platforms. The learners were asked regarding the frequency of engagement, perceived flexibility of learning, trust of certification system and perceived learning effectiveness on these platforms. In the last section of the questionnaire demographic data regarding the respondents were sought, like age, gender, level of education, area of study, level of digital literacy, and the hours of learning engagement per month.

3.3. Model Estimation

A two-stage approach was used to analyze the data. To determine reliability and validity of the scales, the confirmatory factor analysis (CFA) was conducted. Secondly, SEM was done to evaluate the supposed model. The results of CFA are presented in Table 1. All the standardized loadings are above 0.70 and the

Figure 1: Conceptual model



t-values of the associated t-values are significant at the 0.01 level. The values of composite reliability (CR) exceed 0.70 across all constructs indicating high reliability. Moreover, all the values of the average variance extracted (AVE) are over 0.50, which supports the convergent validity of the constructs. In addition, the fit indices of $\chi^2 = 2.84$, CFI = 0.96, NFI = 0.93, TLI = 0.95, SRMR = 0.05 and RMSEA = 0.06 respectively demonstrate a strong overall fit between the data and the hypothesized model and indicates a strong fit.

4. RESULTS

Table 2 has the demographic information of the participants. Females (59.2% of respondents) were more than males (40.8% of respondents). Most of the respondents fell within the age group of 30-39 years (41.7%), then there was 20-29 years (33.5%), and the few (5.9) above 50 years. Almost 43.6% of the respondents indicated that their monthly income was at or below €650. Table 3 demonstrates that the Coursera is the most commonly used decentralized learning system. edX scored the best perceived learning quality, but also was linked to perceived higher cost. LinkedIn Learning was the most career-relevant and Udemy the least, with respect to completion frequency. Moodle-based systems were associated with the least perceived flexibility and engagement, and Khan Academy was perceived as the least career-focused platform among the respondents.

Table 4 shows correlations and descriptive statistics of all variables. The findings showed that there was a significant positive relationship between DLP and DCT, SRLC, and LR. Table 5 shows the results of the hypothesis tests, with the analysis based on 10,000 bootstrap samples. The findings of SEM indicate that DLP do not have a significant effect on LR ($\beta = 0.04$, $P > 0.05$), which causes the rejection of the H_1 . Nevertheless, DLP have significant effect on DCT ($\beta = 0.61$, $P < 0.01$) confirming H_2 . Moreover, it is also seen that DCT has a significant input in LR ($\beta = 0.57$, $P < 0.01$) thus validating H_3 . DLP have a significant effect on SRLC (0.74, $P < 0.01$), which proves H_4 . Moreover, the effect of SRLC on LR is significant ($\beta = 0.38$, $P < 0.01$), which proves H_5 . Also, DLP is positively correlated with LR (H_6), and DCT is a significant mediator in this positive relationship ($\beta = 0.26$, $P = 0.01$). Likewise, SRLC serves as a strong mediator in a positive association between DLP and LR ($\beta = 80.21$, $P < 0.01$) which validates H_7 . Figure 2 gives a graphical illustration of the SEM model.

5. DISCUSSION

Table 1: Psychometric properties of the constructs

Constructs	Std. loadings	t-value	CR	AVE
Decentralized learning platforms	0.94	0.73		
DLP1	0.82	16.21**		
DLP2	0.87	17.88**		
DLP3	0.88	18.05**		
DLP4	0.89	18.41**		
DLP5	0.80	Fixed		
Digital credential trust	0.90	0.64		
DCT1	0.82	15.02**		
DCT2	0.82	15.10**		
DCT3	0.83	15.25**		
DCT4	0.78	14.18**		
DCT5	0.79	Fixed		
Self-regulated learning capacity	0.94	0.78		
SRL1	0.88	20.31**		
SRL2	0.86	19.44**		
SRL3	0.85	18.96**		
SRL4	0.89	Fixed		
Learner retention	0.92	0.69		
LR1	0.89	14.92**		
LR2	0.89	15.03**		
LR3	0.88	14.84**		
LR4	0.76	19.27**		
LR5	0.72	Fixed		

P<0.01

Table 2: Demographic data of the sample (n=318)

Variables	Categories	Frequency	Percentage
Gender	Male	130	40.8
	Female	188	59.2
Age	Under 20	10	3.1
	20-29	107	33.5
	30-39	133	41.7
	40-49	50	15.7
	50+	18	5.9
Education	High school or less	41	12.9
	Bachelor	51	16.0
	Master or higher	226	71.1
Employment	Employed full-time	237	74.5
	Part time	22	6.9
	Self-employed	33	10.4
	Students	21	6.6
	Unemployed	5	1.6
Monthly income	< €350	30	9.4
	€350-€650	139	43.6
	€651-€950	108	33.9
	€951-€1,250	23	7.2
	> €1,250	18	5.7

Table 3: Usage frequency for the selected platforms

Platforms	Usage frequency	Learning quality mean	Cost/effort mean	Career relevance mean
Coursera	2.89	3.22	3.47	3.58
edX	2.26	2.59	2.86	2.75
Udemy	1.87	2.23	2.55	2.37
Future learn	2.68	2.91	3.16	3.15
Linkedin learning	2.24	2.45	2.64	2.61
Khan academy	2.18	2.25	2.40	2.46
Google classroom	2.19	2.36	2.57	2.53
Moodle-based systems	1.75	2.64	3.13	2.54
Blackboard learn	2.87	3.93	4.11	3.76
Canvas LMS	2.82	3.87	4.07	3.77
Blockchain-based learning systems	2.52	3.66	3.91	3.59

The results of this research offer a holistic view of how DLP can impact LR via DCT and SRLC in new models of education. In general, the findings suggest that there is predominantly an indirect mechanism, in which system-level properties are converted into behavioral outcomes via cognitive and trust-based channels. The initial important conclusion is that DLP do not have a strong direct impact on LR. This aligns with other studies that have indicated that technological systems by themselves are ineffective in ensuring sustained engagement without supporting psychological mechanisms (Gomez et al., 2025; Khaldi and Khaldi, 2025). Online learning studies have reported similar findings, with platform accessibility not having a direct impact on persistence until moderated by motivational or cognitive factors (Chimere et al., 2025; Meylani, 2024). This result, though, is different than the previous arguments that flexible learning spaces inherently improve retention by making it convenient and accessible (Langseth et al., 2024; Nguyen, 2025). The current study builds on this argument by showing that structural affordances need internal learner engagement mechanisms in order to generate meaningful results. The second result proves that there is a strong positive association between DLP and DCT. This aligns with the blockchain and digital certification literature, which highlights the fact that transparency and verifiability enhance user trust in the educational outcomes (Deckker et al., 2025; Bao and Liang, 2025).

Similar studies, Han et al. (2025) and Nguyen (2025) also emphasize that DCT is also boosted when learners perceive the authenticity and portability of qualifications. Nonetheless, certain previous study warns that online credentials can be faced with recognition barriers in the traditional job markets, which can undermine trust perception (Msweli, 2026; Qingyi, 2024). Nevertheless, according to the current findings, in the context of decentralized ecosystems, trust is becoming more of a product of system transparency, instead of institutional approval. The third finding reveals that DCT has a significant impact on LR. This observation is heavily explained by the trust-based adoption theories, which states that perceived reliability of outcomes is the main determinant of further engagement (Alwakid and Dahri, 2026; Khaldi and Khaldi, 2025). The empirical evidence of e-learning situations confirms the similarity of empirical evidence between e-learning and non-e-learning contexts (Gupta and Heggond, 2026; Ali et al., 2021). Moreover, Chimere et al. (2025) and Lexman et al. (2024) also highlight that trust can alleviate

uncertainty, hence leading to more persistence in digital systems. Nevertheless, such a finding is somewhat contrary to the reports that suggest that trust alone is not sufficient without motivational support structures (Zira, 2024; Meylani, 2024), and supporting the concept of multi-mechanism models. The fourth result suggests that DLP has a strong positive impact on SRLC. This also aligns with SRL that highlights the need to incorporate autonomy in shaping learning behaviors (Hammami and Alomair, 2026).

Similar empirical studies by Duarte et al. (2025) and Ul Haq et al. (2026) also confirm that online learning environment promote greater self-regulation because of reduced instructor control. Recent studies also indicate that adaptive digital systems positively affect metacognitive awareness and strategic learning behaviors (Alzahrani et al., 2021; Kuo et al., 2023). Nevertheless, other studies also warn that greater autonomy can overwhelm learners with low levels of underlying self-regulatory skills (Lexman et al., 2024; Gomez et al., 2025), indicating that there is variability in the adaption of learners. The fifth outcome shows that SRLC has a significant impact on LR. This is closely correlated with

the existing literature that states that SRL is a major predictor of persistence and academic achievement in the digital environment (Saadati et al., 2023; Langa et al., 2025). The results of the study by Alserhan et al. (2023) and Salah et al. (2026) are in agreement that learners that have greater self-regulation tend to complete courses and remain engaged. This also aligns with previous theoretical discussions by (Meylani, 2024), which confirms the importance of SRL as a key process in autonomous learning situations.

Nevertheless, conflicting literature indicates that the effectiveness of SRL is contextually sensitive, and SRL is dependent on the design of the platform and the quality of feedback (Nguyen, 2025). Lastly, the findings of the mediation confirm that both DCT and SRLC completely mediate the relationship between DLP and LR. This result adds to previous studies combining trust and cognitive regulation into one ecosystem model. Other studies, such as Gomez et al. (2025) and (Qingyi, 2024) also highlight the role of integrating technological and behavioral factors in the understanding of learning outcomes. Additionally, Msweli (2026) and Kalita et al. (2025) are in the opinion that learning analytics and system transparency have an indirect effect on persistence through the mechanisms of learner engagement. The present research is valuable in the sense that it empirically confirms the existence of these two pathways, and more integrated than previous single-mediator models. In general, the results are united by the conclusion that decentralized learning environments have no direct impact on the LR, but instead, indirect psychological and cognitive influences.

Table 4: Correlations among constructs

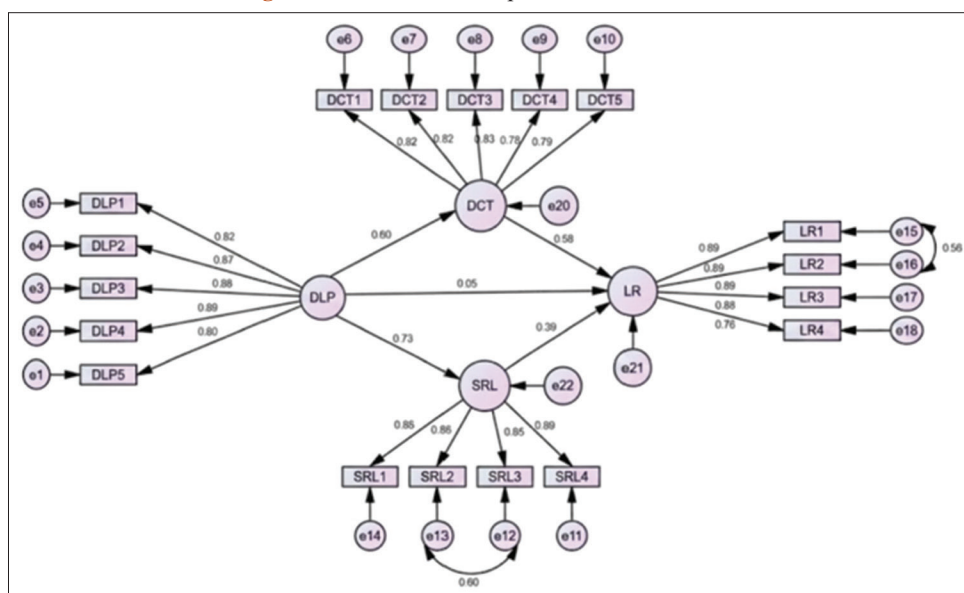
Constructs	Mean	SD	DLP	DCT	SRLC	LR
DLP	3.41	1.09	1			
DCT	3.87	0.88	0.54**	1		
SRLC	3.75	0.93	0.62**	0.74**	1	
LR	3.60	0.96	0.61**	0.77**	0.75**	1

**p<0.01

Table 5: Results of the structural equation modeling (SEM)

Hypotheses test	Std. estimate	Lower bound	Upper bound	P-value	Result
DLP→LR	0.04	-0.11	0.19	0.65	Rejected
DLP→DCT	0.61	0.52	0.70	<0.01	Confirmed
DCT→LR	0.57	0.40	0.73	<0.01	Confirmed
DLP→SRLC	0.74	0.66	0.80	<0.01	Confirmed
SRLC→LR	0.38	0.16	0.60	<0.01	Confirmed
DLP→DCT→LR	0.26	0.18	0.36	<0.01	Confirmed
DLP→SRLC→LR	0.21	0.10	0.34	<0.01	Confirmed

Figure 2: Direct relationships between the variables



5.1. Theoretical Contributions

The theoretical implications made in this study are important since it combines ALET and SRL Theory to understand how learners can be retained in decentralized education systems. First it expands ALET by empirically supporting the fact that DLP have no direct effect on LR but rather act through organized psychological and cognitive processes. This narrows down the previous assumptions in the literature of ecosystem that educational outcomes are driven by technological affordances alone (Deckker et al., 2025). Rather, the results indicate that ecosystem effectiveness is reliant on intermediate constructs, including DCT and learner self-regulation, which support recent calls to adopt multi-layered ecosystem models (Chimere et al., 2025). Second, this research contributes to the development of SRL theory by placing it in the role of a mediating process and not simply a skill outcome. Although previous studies have focused on SRL as a predictor of academic success (Scholapurapu, 2025), the given research shows that SRL is actively influenced by the features of the decentralized system design that include the elements of autonomy, flexibility, and adaptive feedback structures (Langseth et al., 2024). This transforms SRL into a dynamic, system-affected ability as opposed to a fixed attribute of learner. Third, ALET integrates trust into its system, which enhances ecosystem theory by placing emphasis on DCT as an important institutional interface between technology and student behavior. This is in line with emerging literature on digital verification systems (Han et al., 2025; Duarte et al., (2025) and extends the trust theory to decentralized educational settings. In general, the research adds a new dual-pathway model whereby the structures of the ecosystem and the cognition of learners collectively define the retention results.

5.2. Practical Implications

The current research has important practical implications to policymakers, platform developers and educational establishments that operate under decentralized learning environments. First, the results indicate that merely introducing the concept of decentralized platforms is not the key to the success of the LR process; rather, the system designers should work towards the concept of enhancing DCT. Institutions are advised to implement open verification systems, e.g., blockchain-based certification systems, to make learners feel that the achievements they make can be recognized and accepted. This is more so in developing education systems where institutional acknowledgment might be intermittent. Second, the results highlight the importance of fostering SRLC. Built-in learning analytics, adaptive feedback tools, and goal-tracking features should be integrated in educational providers so that they can help the learners manage their own progress. Persistence in decentralized settings can be further promoted by training programs that will develop metacognitive and time-management skills. Third, they must acknowledge that LR is not technology based but is a product of interaction between system design and learner psychology. Thus, the investments should be redirected to platform expansion and system optimization that can increase trust and learner autonomy. Lastly, to avoid disengagement by learners, universities and EdTech providers ought to design learning environments that are both flexible and guided. Through matching technological innovation and the cognitive support

mechanisms, the decentralized system can realize a sustainable learner engagement and enhanced educational outcomes.

6. CONCLUSION, LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

This work offers a detailed analysis of the impact of DLP on LR via DCT and SRLC in adaptive learning eco-systems. The results indicate that the effects of the decentralized systems are not direct but are fully mediated by cognitive and trust-based processes. Combining ALET and SRL, the study contributes to a more nuanced view of the interaction between technological infrastructures and learner agency to formulate educational outcomes. The findings point to the fact that LR in decentralized systems relies on the institutional credibility and personal learning ability. DCT provides perceived legitimacy of the learning outcomes, whereas SRLC facilitates long-term engagement and goal-oriented behaviour. The combination of these mechanisms creates a two-pathway that can be used to explain how technological innovation can be transformed into educational continuity through these mechanisms. Overall, the study can contribute to the further development of the discussion about future education systems because, in addition to the high-level digital information system, the effective system of psychological and cognitive support should be in place as well.

Although this study has made its contributions, it has a number of limitations to be considered. To start with, cross-sectional survey data fails to facilitate dynamic changes in the learner behaviour over time. The longitudinal designs would give more information about the development of trust and self-regulation during the learning process. Second, the research uses self-reported measurements, which can have response bias and social desirability. Subsequent studies may include the objective learning analytics information on platforms to confirm the behavioral patterns more closely. Third, the study targets a particular context of a developing country, which can constrain generalizability to other cultural and institutional contexts. Cross country studies may be conducted on a larger scale to give greater validation of the proposed model. Fourth, although the research combines ALET and SRL theory, other potentially relevant theories like motivation theory or technology acceptance models were not mentioned. Further studies may establish more holistic hybrid models with other psychological and technological constructs. Lastly, moderating variables like digital literacy, institutional support, and AI-driven personalization need to be explored in future studies to enhance the understanding of boundary conditions of LR in decentralized systems.

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