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Effect of Digital-Technology-Based Learning Environment Integrated with Reflective Thinking Activities on College Students' Learning Motivation

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Abstract

Reflective thinking enables learners to critically examine their experiences and supports Sustainable Development Goal 4 (Quality Education) by preparing students for meaningful engagement with learning. Despite its recognized importance, structured reflective thinking activities (RTA) remain underutilized in Pakistani higher education, and notable gaps exist in the literature regarding their effectiveness when facilitated through digital technology. This study examined the effect of a digital-technology-based learning environment integrated with RTA on college students' learning motivation, using a true-experimental, pre-test post-test control group design. Thirty female fourth-year students enrolled in an educational psychology course at a public associate college in Punjab were randomly assigned to experimental and control groups. Over seven weeks, both groups attended one-hour classes incorporating multimedia instructional videos; the experimental group additionally engaged in structured RTA based on Gibbs' Reflective Cycle. Learning motivation was assessed using a researcher-developed, validated 40-item Likert scale instrument (Cronbach's $\alpha = 0.82$). Results showed no significant baseline difference between groups, but the experimental group demonstrated significantly greater post-test learning motivation than the control group ($t(28) = 3.03$, $p = .005$), with a large effect size (Cohen's $d = 1.11$). These findings indicate that structured RTA, when integrated with digital technology, can meaningfully enhance college students' learning motivation and should be incorporated into higher education instructional practice.

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Introduction

Digital-technology has revolutionized higher education by shaping more flexible, interactive, and technologically-mediated learning environments. However, only digital-technology is not enough for meaningful learning; opportunities for learners to construct knowledge is crucial for its educational value (Otto et al., 2024; Arzeman et al., 2026). Recent studies indicate that effective digital-technology-based environments extend beyond the mere presence of the technology; they are also characterized by being interactive, easy to use, giving immediate feedback and providing opportunities for the learners to engage actively with the material they

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are learning (Arzeman et al., 2026; Bergdahl et al., 2024). The way digital-technology is used in higher education context today needs pedagogies that do not just transmit information but also encourage critical examination, deeper engagement, and meaningful learning experiences. Reflective thinking is gaining prominence as a skill that allows learners to reflect on their experiences, establish links between new experiences and previous experiences, challenge their beliefs, and formulate deeper interpretations of learning experiences in rapidly changing educational landscape (Oliveira et al., 2022; Awidi & Klutsey, 2025). The reflection process is not just about recalling what has happened but also a process in which individuals reflect on their experiences in a planned way, by looking at what happened, how, why, and what might happen next in the learning process (Ryan, 2015; Oliveira et al., 2022). Recent research studies have indicated that structured RTA can be effectively used in blended and digitally enabled learning environments to offer opportunities for learners to reflect more intentionally on their process of learning (Awidi & Klutsey, 2025). From this perspective, reflection is seen as an essential process for transforming digital learning into more active and meaningful activity in achieving learning outcomes, from a content delivery activity. The importance of reflective thinking is based on the notion that the learning is not just about receiving information. Learners construct their knowledge by making sense of their experiences, revisiting their prior schema, and connecting new knowledge with their existing schema (Kolb, 1984; Schön, 1983).

Structured reflection models can provide learners important guidance in developing meaningful reflection. Gibbs' (1988) Reflective Cycle is helpful as it breaks reflection into six stages: “description, feelings, evaluation, analysis, conclusion, and action plan”. The model provides a systematic course of action for learners to follow from describing an experience to considering its meaning, examining issues, drawing conclusions and thinking about what they might do next (Gibbs, 1988). Present studies on structured reflection have also shown that the design of the reflection activity could also be important as learners might need to be given prompts and scaffolding to get them to reflect beyond just a surface-level reflective writing (Oliveira et al., 2022; Awidi & Klutsey, 2025).

Moreover, the dominant traditional ways of teaching may have several negative impacts on education. Learners might have continued to engage in superficial learning, limiting their skills to critical thinking, problem solving, and meaningful understanding of certain topics (Panadero et al., 2022). In addition, the low reflective involvement can negatively impact students' readiness to learning, potentially resulting in reduced academic involvement, confidence, and persistence in learning activities (Forsström et al., 2025). Unless they are addressed, educational institutions can keep producing students who lack the skills to make critical decisions, self-directed learning, and adapting to rapidly evolving world.

Despite its significance, the incorporation of structured reflective thinking activities (RTA) remains restricted in Pakistan. Numerous international studies (e.g., Karaoglan et al., 2017, Agnes & Sutimin, 2019, Huseyin et al., 2021, Siahaan et al., 2021, Awidi & Klutsey, 2025) have examined reflective thinking, but few have focused on the Pakistani context (e.g., Tariq et al., 2024, Aslam et al., 2021; Buzdar & Ali, 2013). And the studies conducted were mainly focused on exploring the reflective practices of teachers.

Table 1

Summary of International research studies

Author	Aim	Research approach	Findings
(Karaoglan et al., 2017)	To examine students' perceptions of their social presence, academic success, and motivation are affected by e-learning settings combined with reflective thinking exercises.	Experimental study	The study's findings demonstrated that organized reflection significantly boosts pupils' motivation.
(Agnes & Sutimin, 2019)	To create a reflective pedagogy-based module and demonstrate how it affects students' motivation	Developmental study, Indonesia	The module increased pupils' motivation, according to the results.
(Huseyin et al., 2021)	To look into potential relationships between academic achievement and metacognitive awareness level	Descriptive survey method, Turkey	It was determined that their degree of metacognitive awareness were positively impacted by their academic achievement.
(Siahaan et al., 2021)	To investigate how students' motivation and writing skills are affected by reflective journal writing.	Mix-method approach	Students' motivation and writing skills were significantly enhanced by reflective journal writing, with a significant impact on students' motivation to study.
(Awidi & Klutsey, 2025)	To find out how critical reflection assignments affect students' confidence, motivation, and participation in higher education	Mixed-methods research study	The findings showed that students' motivation is greatly increased by critical reflection exercises.

Thus, there is significant population, contextual and empirical gap in the literature regarding the effectiveness of structured reflective activities facilitated with digital-technology, in improving college students' learning motivation in Pakistan. To fill these gaps, the present study examined the "Effect of digital-technology-based learning environment integrated with RTA on college students' learning motivation".

Objective of the Study

The research objective of the study as follows; to examine the effect of digital-technology-based learning environment integrated with reflective thinking activities on college students' learning motivation in Pakistan.

Research Question

a. The research study address the following research question: What is the effect of digital-technology-based learning environment integrated with reflective thinking activities on students' learning motivation?

Research Methodology:

Research Design and Approach:

The study was situated within the positivist paradigm and employed a quantitative research design to investigate the effect of a digital-technology-based learning environment integrated with RTA on students' learning motivation. A true-experimental, pre-test post-test control group design was used.

Target Population

The target population involved female fourth year students enrolled in educational psychology course at a Public Associate College in Punjab.

Sampling

Convenience sampling was used to select the college, and the entire fourth-year class was included in the study. Students were then randomly assigned to the experimental and control groups, yielding a total sample of 30 students

Research Instrument

The researcher-developed instrument of learning motivation consisting of five point likert scale, with 40 items in its final version was used to measure students' learning motivation.

Validity of Instrument

The learning motivation instrument was validated by subject experts and necessary revision were made accordingly. The questionnaire initially consists of 30 items relating to Intrinsic Motivation, Extrinsic Motivation, Amotivation, Self-Efficacy, Task Value and Learning belief. Following expert feedback, items addressing the digital-technology-based environment and students' response to RTA were added, resulting in a final instrument of 40 items.

Piloting of the Instrument

The instrument was piloted with a comparable group of students, and minor revisions were made based on the pilot results. Instrument reliability was calculated using SPSS.

Table 2

Cronbach's Alpha Reliability of Learning Motivation Instrument

Scale	No of Items	Mean	*SD*	Cronbach's alpha
Learning Motivation Instrument	40	156.13	12.84	0.82

The Cronbach's Alpha value for the Learning Motivation instrument was 0.82 which is considered as good reliability.

Intervention Procedure

The intervention spanned seven weeks, with one hour class conducted in digital-technology-based learning environment incorporating multimedia videos. At the end of each lecture a reflection activity was conducted. Reflective thinking questions based on Gibbs' reflective cycle were presented to students who recorded their responses in reflective journals. Participants were randomly assigned to the experimental and control groups: the experimental group received multimedia video instruction integrated with RTA, while the control group received multimedia video instruction without RTA. A pre-test was administered before the intervention to measure students' baseline learning motivation, and a post-test was administered afterward to assess changes in learning motivation following instruction in a digital-technology-based learning environment integrated with RTA.

Data Analysis Procedure

Data were analysed quantitatively using SPSS-21. Descriptive statistics (Mean and Standard Deviation) and inferential statistics were calculated. Independent sample t-test was applied to compare the pre-test and post-test scores of experimental and control group, following verification of the assumptions underlying the t-test. Cohen's d was calculated to determine effect size, and paired-samples t-tests were used for within-group comparisons.

Hypotheses Testing

$H_{01:}$ There is no effect of digital-technology-based learning environment integrated with reflective thinking activities on students' learning motivation; $\mu_C = \mu_E$

Table 3

Descriptive Statistics of Experimental and Control Groups

Group	*n*	Test	Mean	*SD*
Experimental	15	Pre-test	158.80	12.45
Experimental	15	Post-test	172.67	10.33
Control	15	Pre-test	153.47	13.08
Control	15	Post-test	158.53	14.76

Table 3 shows that the experimental group's mean scores rose from the pre-test (M = 158.80, SD = 12.45) to the post-test (M = 172.67, SD = 10.33), while the control group's mean scores rose from the pre-test (M = 153.47, SD = 13.08) to the post-test (M = 158.53, SD = 14.76). The relatively small difference between the two groups' pre-test scores indicates that the groups were comparable before treatment; following the intervention, however, the experimental group showed a markedly greater improvement in post-test scores.

Table 4

Shapiro-Wilk Test of Normality for Pre-test and Post-test of Experimental and Control Group

Group	Test	*n*	*W*	*df*	*p*
Experimental	Pre-test	15	.97	15	0.78
	Post-test	15	.94	15	0.39
Control	Pre-test	15	.95	15	0.50
	Post-test	15	.95	15	0.46

The Shapiro–Wilk test was used to assess the normality of pre-test and post-test scores for both groups. Because p > .05 in all cases, the pre-test and post-test scores of both groups were normally distributed.

Table 5

Comparison of Pre-test Scores of Experimental and Control Group (Independent Sample t-Test)

Group	*n*	Mean	*SD*	*df*	*t*	*p*	95% CI of the difference
Experimental	15	158.80	12.45	28	1.144	.262	(-4.21, 14.88)
Control	15	153.47	13.08				

(p > 0.05)

Table 5 indicates that there is no significant difference between mean scores of experimental group (*M* = 158.80, *SD* = 12.45) and control group (*M* = 153.47, *SD* = 13.08) as *t (28)* = 1.144, *p* = .262 (*p > 0.05),* 95% CI (-4.21, 14.88), indicating that the two groups were equivalent at baseline. The null hypothesis could not be rejected on this basis.

Table 6

Comparison of Post-test scores of Experimental and Control Group (Independent Sample t-Test)

Group	*n*	Mean	*SD*	*df*	*t*	*p*	95% CI of the difference	Cohen's *d*
Experimental	15	172.67	10.33	28	3.03	.005	(4.60, 23.66)	1.11

Control		15	158.53	14.76					

(p < 0.05)

Table 6 indicates that there is significant difference between mean scores of experimental group (*M* = 172.67, *SD* = 10.33) and control group (M = 158.53, SD = 14.76) as t (28) = 3.03, p = .005 (p < 0.05), 95% CI (4.60, 23.66), leading to rejection of the null hypothesis. The experimental group performed significantly better than the control group following the intervention, with Cohen's d = 1.11, indicating a large effect size (Cohen, 1988).

Table 7

Comparison of Pre-test and Post-test Motivation Scores of Experimental Group (Paired Sample t-Test)

Group	Test	*n*	Mean	*SD*	*df*	*t*	*p*	95% CI of the difference	Cohen's *d*
Experimental	Pre-test	15	158.80	12.45	14	-7.27	.001	(-17.95, -9.78)	-1.21
	Post-test		172.67	10.33					

(p < 0.05)

A paired-samples t-test comparing the experimental group's pre-test (M = 158.80, SD = 12.45) and post-test scores (M = 172.67, SD = 10.33) revealed a significant difference, t(14) = −7.27, p = .001 (p < .05), 95% CI [−17.95, −9.78], indicating a substantial improvement in students' motivation following the intervention. The effect size, Cohen's d = −1.21, is considered large (Cohen, 1988).

Table 8

Comparison of Pre-test and Post-test Motivation Scores of Control Group (Paired Sample t-Test)

Group	Test	*n*	Mean	*SD*	*t*	*df*	*p*	95% CI of the difference	Cohen's *d*
Control	Pre-test	15	153.47	13.08	-2.49	14	.02	(-9.43, -7.04)	-0.36
	Post-test		158.53	14.76					

(*p* < 0.05)

A paired-samples t-test comparing the control group's pre-test (M = 153.47, SD = 13.08) and post-test scores (M = 158.53, SD = 14.76) also revealed a significant difference, $t(14) = -2.49$, $p = .02$ ($p < .05$), 95% CI [−9.43, −7.04], indicating that the control group's motivation improved as well, though with a small-to-medium effect size, Cohen's $d = -0.36$ (Cohen, 1988).

Discussion and Conclusion:

Summary of Key Results

The research question guiding this was: What is the effect of digital-technology-based learning environment integrated with reflective thinking activities on students' learning motivation?

The pre-test results showed that there were no statistically significant differences between the experimental and control groups, which means that the two groups had similar levels of learning motivation prior to the intervention. This baseline equivalence confirms that any differences at the post-test stage were most likely due to the reflective thinking intervention and not to differences in motivation between groups. The independent-samples t-test result showed that the learning motivation score of students in the experimental group was significantly higher than that of the control group after the intervention. Moreover, the effect size was large (Cohen's $d = 1.11$), suggesting that RTA had significant practical impacts on students' learning motivation. The results of this study indicate that reflection positively affected the willingness of students to engage in academic learning activities, put in effort, persist in difficult tasks, and take responsibility for the learning process. This can be attributed to the fact that reflective thinking shifts the students from a role of just a receiver of knowledge to an active participant in the learning process. Reflective activities allowed students to continuously assess their understanding, identify strengths, track learning progress, and develop plans for improvement. This dynamic interaction probably enhanced students' intrinsic motivation and commitment to learning more, thereby fostering a sense of ownership.

Within-Group Gains

Learning motivation improved in both groups from pre-test to post-test, suggesting that the overall instructional process benefited both groups and that students grew increasingly motivated as they progressed through the educational psychology course. This improvement may be attributable regular classroom teaching, constant communication with the teacher and the learning through videos incorporated in content through multimedia have influenced the students' motivation. The gains observed in the control group may specifically reflect the interactive and engaging nature of instructional videos relative to traditional lecture-based teaching. Although both groups improved, the experimental group's gains were significantly larger, suggesting that reflective thinking contributed additional motivational benefit beyond that provided by multimedia instruction alone. Structured RTA enabled students to evaluate their learning experiences, identify strengths and weaknesses, consolidate their learning, and plan for future improvement. These activities encouraged active engagement and ownership of learning, likely reinforcing students' interest and commitment to the learning process.

Effect Size Interpretation

Results showed that learning motivation variable had a large effect size (Cohen's d = 1.11) and there was a statistically significant difference in both groups. The statistical significance means that a difference observed was not likely due to chance, but the effect size is a measure of the magnitude and the practical significance of the observed difference. Thus, the large effect size indicates that the RTA had a significant and meaningful impact on the students' learning motivation. The results showed that the students who were involved in the structured RTA were more motivated in learning process than the students who were not involved in RTA. This indicates that RT was not only helpful for their academic learning but also for their interest, engagement and commitment in learning course content. In an educational context, the large effect size indicates that the intervention had a significant impact on students' motivation that is likely to impact their persistence in learning and classroom engagement.

Comparison with Literature

The findings are consistent with the findings of other research studies conducted on similar variable in the literature. A study was carried out by Tariq et al. (2024) to examine how reflective learning practices affect the critical thinking ability and learning motivation of undergraduate students in a chemistry course. The researchers used an experimental research design and concluded that learning motivation of students who were given structured RTA was significantly higher (large effect size) than the students who were given conventional learning. The authors suggested that reflective learning helps students to relate theory to reality, enhance their sense of ownership of learning and stay involved in the learning process. Furthermore, the results of the present study are similar to the research performed by Awidi and Klutsey (2025) on the effect of online critical reflection on students' confidence, motivation and engagement in higher education. The authors conducted a study using a mixed-methods design with 137 undergraduate students in a blended learning environment that demonstrated strong positive influence on the students' motivation to learn, confidence, and engagement due to structured critical reflection. They said that reflective learning activities helped students to gain more knowledge about the contents of the course, understand the meaning of learning activities, and be more active in learning the course. In addition, prompt and positive feedback given as part of the reflective process enhanced students' motivation to engage and to continue their learning processes. These outcomes parallel the present findings, in which students exposed to RTA reported significantly higher learning motivation than those receiving conventional instruction.

This pattern is further supported by Siahaan et al. (2021), who found in a mixed-methods study of 70 high school students that reflective journal writing, used as an authentic assessment tool, significantly improved both writing competence and learning motivation (η^2 = 0.864) relative to a control group receiving traditional instruction. Likewise, Putri (2020), revealed the students' motivation increased when they were engaged in reflective activities based on Gibbs' reflective cycle, supported by technological tools (e.g., digital learning environments) as part of a research-based instruction course. Furthermore, Karaoglan, Yılmaz and Keser (2017) conducted a critical review of empirical research on RTA in online learning environments and came to the conclusion that structured reflection significantly improves students' motivation. Another study was conducted to examine the impact of reflective journal

writing on students' motivation. The results of the study showed that students who took part in structured reflective writing had a much higher level of learning motivation than the students who did not take part in structured reflective writing (Amirkhanova et al., 2016).

This study contributes to the literature by providing empirical evidence for the effectiveness of structured RTA in improving students' learning motivation, while extending the application of Gibbs' Reflective Cycle by demonstrating its efficacy when integrated with digital technology in higher education. Building on these findings, future researchers should consider conducting longitudinal studies to examine the long-term effects of reflective interventions, replicating this work with larger and more diverse samples across disciplines, educational levels, genders, and cultural contexts to strengthen generalizability, comparing different reflection models to identify which yield the strongest outcomes, and adopting mixed-methods designs to capture both quantitative and qualitative shifts in learning motivation. For practitioners, these results underscore the value of systematically embedding structured RTA into classroom instruction and formal assessment through digital platforms, while for policymakers and curriculum developers, they point to the importance of establishing reflective activities as a core component of curricula across subjects and grade levels.

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