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Effect of Integrated Online Quizzes as a Formative Assessment Strategy on Cognitive Engagement of Distance Learners

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Abstract

Educational websites have transformed conventional assessments into more engaging activity. But still faculty of Distance University face a lack learner's cognitive engagement. To solve this problem, the study has designed two objectives to investigate effect of integrated web-based online quizzes as a formative assessment strategy on cognitive engagement of distance learners. To achieve study's objective, online quizzes have integrated in practice-based experiential learning to develop coherence in learning activities to assess changes in their cognitive engagement. A positivist paradigm and a type of quasi-experimental design, pretest posttest test have selected in absence of the true basic experimental design. In this design, 28 distance learners have been selected by convenience technique from the Faculty of Education at Allama Iqbal Open University. By following the design, their cognitive engagement were measured two times at same point. To examine it, an adaptive questionnaire has administered them to collect the data. The collected data has been analyzed by paired sample t-test to demonstrate differences in their cognitive engagement. By following eight weeks intervention, the p -value $.000 < .005$ shows a significant difference in their cognitive engagement, since they set learning goals, adapted organization and summarization strategies to achieve them. Their metacognition has intrinsically motivated them to persist in semester no matter what learning challenges arose. These findings recommend teachers and policymakers to embed websites in curriculum and lesson planning for implementing online quizzes as a formative assessment strategy to foster their cognitive engagement. Online quizzes effective implementation boost learners' active attention, participation, intrinsic motivation and persistence resulting academic excellence, deep thinking and prevent dropouts.

Keywords: web-based online quizzes, formative assessment strategy, practice-based experiential learning, cognitive engagement, distance learners

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Introduction

The expansion of web technologies has fuelled significant growth of distance education. This significant growth was accelerated by the COVID-19 pandemic, which spurred the adoption of advanced educational websites (Zarifsanaiey et al., 2024). These advanced websites utilize platforms, adaptive assessments, and real-time feedback systems that enhance personalization, equity, and collaboration in underserved regions (Yaseen et al., 2025). Despite the rise of these technologies in higher education, it is still unknown how integrated online quizzes convert assessment data into valuable insights that improve learners' cognitive engagement. Existing studies such as Al-Khresheh et al. (2025) on online quizzes as a formative assessment have offered limited exploration or investigation in distance education at the university level. Likewise, the study by Qammar Naz and Aroona Hashmi (2025) investigated the effect of a digital formative assessment framework on students' learning trajectories in their cognitive domain at the higher education level. A recent study of Nguyen et al. (2023) explored the utilization of online assessment strategies in a blended learning context. A prior study by Pertiwi (2021) investigated effectiveness of problem-based learning assisted by Quizizz media to improve critical thinking skills. Further, existing study of a Morris (2020) explored systematic literature review, and revision of Kolb's model: Experiential Learning. A study of Capinding (2022) explored the utilization, and effectiveness of Quizizz (game-based assessment) in improving intrinsic motivation, and interest among secondary school students. This limited investigation is a pushing need to investigate significant challenges such as low learner's cognitive engagement that prevent high dropout rates in online learning environment at university level (Polat et al., 2024).

Online quizzes are a subpart of formative assessment; they are effective when integrated into teaching methods as their effect is limited when used in isolation (Laaziz et al., 2024). Therefore, practice-based experiential learning (PBEL) was selected to investigate the effect of online quizzes as a formative strategy on cognitive engagement of distance learners. This learning style can be defined as a set of learning activities, including online quizzes, presentations, discussions, projects, and feedback that assist learners in effective learning (Heyworth & Thomas, 2023). The purpose of web-based online quizzes in practice-based experiential learning (PBEL) was to reduce learning misconceptions through instant constructive feedback, and to motivate learners to pay sustained attention in their academic career. Additionally, the study of Hinze et al. (2022) suggested that learners must allocate enough time for 'learning by doing' or experiential-based learning. According to the study of Perdana and Permatawati (2019) learners who are actively involved in learning activities participate more and attain higher-order thinking knowledge compared to those who are less engaged. Online quizzes are one of the formative assessment strategies that can take place at different times during any academic course, and they can also be considered low-stakes (Lubrick & Wellington, 2022).

They are beneficial to both teachers and learners; teacher can evaluate their teaching methods, while learners can monitor their own performances (Al-Bahadli et al., 2023). Furthermore, a meta-analysis of Sotola and Crede (2021) summarized the use of quizzes in classrooms and concluded that they are valuable tools for encouraging learners to attend classes regularly and review the content. Online quizzes were introduced as a formative assessment in response to decreased attendance in a business management course at Liverpool John Moores University. The findings suggested that learners achieved high academic performance when quizzes were taken seriously (Duckworth et al., 2011). These results point towards the potential of online quizzes to not only improve learning outcomes but also boost learners' engagement in diverse instructional settings. Hence, in the present study 'Quizizz' was selected to implement integrated online quizzes as a formative assessment strategy to improve learner's digital assessment experience (Sorohiti et al., 2024). It is suitable for an

assessment strategy because teachers can quickly download reports and evaluate learners' performance within content delivery (Heyworth et al., 2023). In addition, It provides online features in assessment such as modes, themes, points, easy login, and a dashboard that enhance learners' engagement and motivation, which results in their ability to pay sustained attention (Plump & Larosa, 2021). Sustained attention in learning is a critical feature that regulates cognitive strategies, and keeps learners engaged (Khatter et al., 2024).

Research Objectives

The study has investigated these objectives to;

- 1: Determine the effect of integrated web-based online quizzes on metacognition, and strategic learning as a formative assessment strategy among distance learners.
- 2: Find the effect of integrated web-based online quizzes on persistence, and intrinsic motivation levels as a formative assessment strategy among distance learners.

Hypotheses

H₁: Integrated web-based online quizzes have a significant effect on metacognition, and strategic learning as a formative assessment strategy among distance learners.

H₂: Integrated web-based online quizzes have a significant effect on persistence, and intrinsic motivation levels as a formative assessment strategy among distance learners.

Literature Review

Theoretical Framework

Engagement is the condition of enhancement and participation (Sotola & Crede 2021). It can be understood by including three domains of engagement cognitive, emotional, behavioral, and social. Cognitive engagement is associated with mental effort, metacognition, and sustained attention in academic tasks (Fredricks et al., 2015). To achieve study's objectives, cognitive engagement has investigated through the support of the 'Self-Regulatory Learning Engagement (SRL)' model given by Zimmerman (2012). The model explains learners engage in cyclical process of SRL, which encompasses metacognition. It demonstrates a cyclical process in three phases; (1) forethought, (2) performance, (3) reflection, and intrinsic motivation facilitates these three phases. It emphasizes the use of cognitive, and metacognitive strategies (goal setting, monitoring, and strategies of learning) provides indicators of self-regulatory engagement. Engagement is seen as fuel, adjusting over different phases depending on (1) feedback, (2) goal setting, (3) task demand. Learners are the active agents in learning process who regulate, initiate, evaluate their engagement and learning strategies (organization and summarization). In forethought phase, they set a specific goal, and adapt appropriate learning strategies for achieving it. In performance phase, they actively monitor their performances. In reflection phase, they evaluate effectiveness of their engagement (effort and strategies).

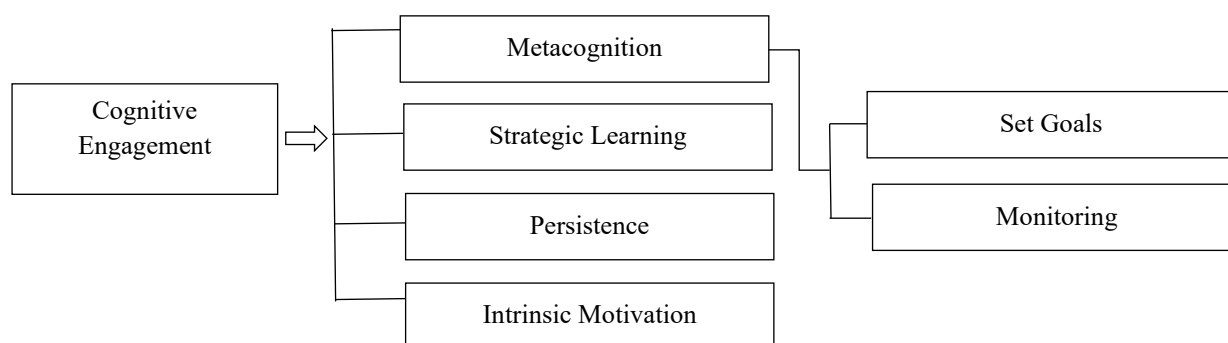


Figure 1: Conceptual Framework

Cognitive engagement, and self-regulation learning overlap in nature, but studies of Cleary and Zimmerman (2012) have identified key differences between them. As cognitive engagement refers to the degree of mental effort that learners invest in using strategies for understanding and problem solving, whereas self-regulatory learning extends beyond this by involving the ongoing management of cognitive effort, regulation of strategies, adaptation to environmental and internal constraints.

Research Methodology and Procedure

The positivist paradigm has supported investigating the effect of integrated online quizzes as a formative assessment strategy on cognitive engagement by observable data. It has some assumptions as it establishes reliable data through rigorous statistical analysis, which is required condition for generalizing about the real world (Creswell et al., 2018). Further, the population of the study was selected using a purposive technique (the key reason for selection, this institution conducts online classes in an allocated time (3 hours) for MPhil scholars). A letter was written to chairman of the department to select a sample from education department; permission was received from the authority. To select sample, a formal letter was written to course coordinators along with intervention purpose and timeline. One of the course coordinator had given me permission to implement eight weeks' intervention with strict adherence. The course coordinator was taking classes in the Secondary Teacher Education program, the 28 distance learners were enrolled in it, therefore, they were selected by using a convenience technique. An intact was selected in absence of random assignment (in real education setting, lack of similar class, group and population highlighted by (Cohen et al., 2018). The selected learners were taking course 3748 'Qualitative Research in Education'. The selected design has given insight to investigate differences among an intact group. The design was followed as;

O1 X O2

O1 (Pre-test), **X** (intervention or treatment), **O2** (post-test)

Instrument

An adapted questionnaire was used for investigating learners' cognitive engagement. The rationale was that it provided items that directly measured distance learners' cognitive engagement. It consisted on 30 items; 27 items were adapted from the (MSLQ) questionnaire Pintrich (2000) and, 3 new items were added to investigate metacognition, and persistence level. To ensure its validity, I-CVI/I-SVI was calculated; results presents I-CVI=27.4, while I-SVI=0.91 (five experts were selected to ensure validity of adapted instrument, these were experts in the domain of online learning) (Annexure A). While, reliability was evaluated (10

MPhil learners were selected from teacher education departments before collecting actual data) by Cronbach's Alpha that was showed value $\alpha=.898$. To collect data from 28 distance learners, an informed consent was sent to them.

Intervention Procedure

The course of 'Qualitative Research in Education' comprised nine units (1-9) that were designed to develop an understanding of qualitative research in education. The study has followed formative assessments (integrated web-based online quizzes) to assess learners' cognitive engagement as a strategy. It has been designed in a way that the study's objectives can be investigated, (metacognition, strategic learning, persistence, and intrinsic motivation levels). There were 8 online quizzes as a formative assessments administered once a week. Online quizzes consisted on 3 short questions answers; the total questions were 24 in 8 weeks. Online quizzes as a formative assessment strategy have been directly aligned with the course content, covering units 1-9. The questions were content-free in nature, utilized scenarios to enhance deep learning.

Online quizzes in practice-based experiential learning (PBEL) as a formative assessment strategy have been divided into two segments. The purpose of the division was to make a 3-hour online classroom more engaging and attract distance learners' active attention. Their active attention leads to effective learning resulting in quality improvement of the online learning environment, which prevents dropout rates during program completion. Figure 2 illustrates the scope of intervention;

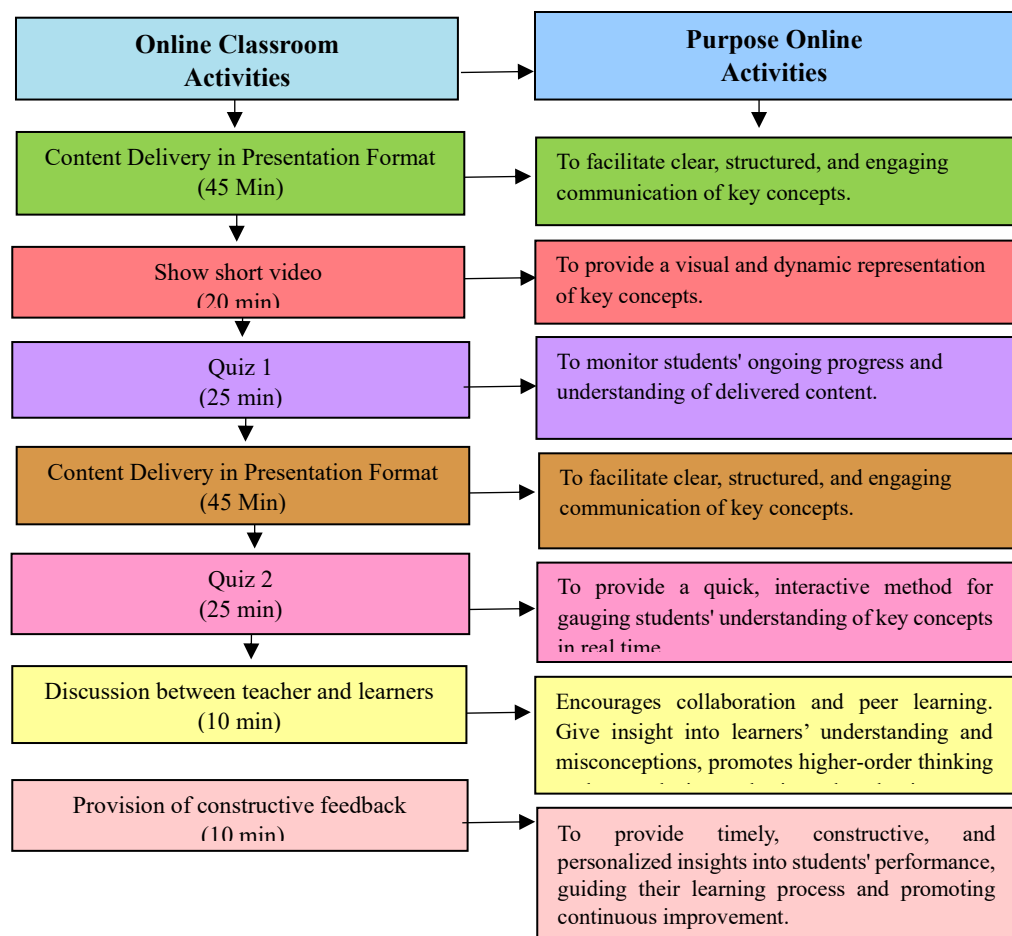


Figure 2: Scope of the Study

The teacher started teaching from basic concepts of the topic in a presentation format for 45 minutes. After that, a teacher played a video related to the topic for 20 minutes. This activity provided an initial experience to learners of the content. It was passive information, but it provided a concrete starting point. This activity was encouraged them to think about what they have learnt. To measure their baseline knowledge before the intervention, a paper-based formative assessment was administered to them for 25 minutes to investigate what they had learnt. First two questions (1-2) were given in segment 1st, and 3rd question in segment 2. After 25 minutes were passed, they shared their paper-based assessments through snapshots. The purpose of the paper-based assessment over 4 weeks was to investigate the significant effect by combining two elements (paper-based, and web-based online quizzes). This whole process was repeated again in a 3-hours online class by considering two segments. After passing 4 weeks, an adaptive questionnaire (MSLQ) was administered to them. The teacher delivered the content to learners in a presentation format for 45 minutes. The teacher administered web-based online quizzes for 25 minutes to understand what they have acquired. Teachers has instructed them to visit 'Quizizz' for online quizzes as a formative assessment. Then the teacher has shared a PIN code with them through the LMS Chat Box. By entering a code, they were able to log into online quizzes. They had entered their names, and online quizzes have started. After that, short questions answers were displayed on their screen (mobile phones, laptops and computers). The 5 minutes were allocated for attempting each question (sufficient time for attempting a question). First two short questions were given in the 1st segment, and third in 2nd segment.

After completing quizzes, the results with the learners' names were displayed on the dashboard of 'Quizizz'. The assessment report was automatically generated with their names. The teacher held discussion to evaluate what was done well or not for 10 minutes. After the discussion, they received instant constructive feedback on topic misconceptions, and terminologies for 10 minutes. It was intended to engage them cognitively, and support their metacognition in the learning process. This whole process has been repeated again in 3-hours online classes. Potentially, integrated web-based online quizzes were a reflection, and experiment with associated learning activities for assessing learners' cognitive engagement. After implementing 4 weeks intervention, an adapted questionnaire was again administered to them to investigate changes in their cognitive engagement. The collected data from online quizzes as a formative assessment strategy has been utilized for evaluating well-balanced assessment (Riyanti & Nugroho, 2023), and provision of instant constructive feedback. The learners who responded to the questions in a short time got the highest marks in quizzes, but grading criteria has been pre-designed (VSQ) for grading assessments (Cohen et al., 2018). This was based on accuracy, completeness, conciseness, relevance, clarity, and terminology with specific ranges.

Data Analysis and Results

To examine the effect of integrated online quizzes as a formative assessment strategy over 8 weeks, a paired samples t-test has been used to compare pre-test, and post-test scores. The test was chosen to determine whether the mean scores of an intact group changed significantly after implementing the intervention.

Table 1*Results of Metacognition and Strategic Learning*

Sr	Pair	Mean		Gain	SD	Interval Confidence level	Df	t	Sig
		X1	X2						
1	Pre-Metacognition Post-Metacognition	6.33	9.03	2.70	2.03	95%	27	-7.03	.000
2	Pre-Strategic Learning Post-Strategic Learning	17.50	22.52	5.02	4.20	95%	27	-6.32	.000

A t-test demonstrated a significant increase in learners' cognitive engagement such as mean score of metacognition is increased from 6.33 to 9.03, with a gain 2.70 points ($t=-7.03$, 95% confidence level). The gain presents online quizzes successfully facilitated them in setting goals, and monitoring performance; it has given an opportunity to become active agent of their learning in online classes. Similarly, the strategic learning mean score increased from 17.50 to 22.52, showing a gain 5.02 points ($t=-6.32$, 95% confidence level). The gain shows online quizzes enhanced their learning strategies (organization, and summarization) significantly through reinforcement, associated feedback, and discussion. As, they have adapted strategies that assisted them to achieve set goals effectively.

Table 2*Results of Persistent and Intrinsic Motivation Levels*

Sr	Pair Levels	Mean		Gain	SD	Interval Confidence level	Df	t	Sig
		X1	X2						
3	Pre-Persistence Post-Persistent	15.28	17.15	1.86	1.39	95%	27	-7.06	.000
4	Pre-Intrinsic Motivation Post-Intrinsic Motivation	16.96	22.34	5.36	4.97	95%	27	-5.72	.000

A notable increase was also observed in persistence level, with the mean score which increased from 15.28 to 17.15, presents gain 1.86 points ($t=-7.06$, 95% confidence level). It demonstrates continuous provision of instant constructive feedback, and opportunity to monitor performances motivated them to pay sustained attention in learning process. Ultimately, intrinsic motivation level mean scores increased from 16.96 to 22.34, with a gain 5.36 points ($t=-5.72$, 95% confidence level). It showed associated activities with online quizzes (instant constructive feedback, discussion) intrinsically motivated them as they satisfied in learning due to correction of learning doubts immediately that given mastery in content. Similarly, features of online quizzes such as modes, themes, easy login, dashboard, and points were also captured their attention towards effective learning by grasping their attention from personal commitments. These findings collectively indicate the intervention was highly effective in improving cognitive engagement of distance learners; ($p=.000<.005$) suggests acceptance of the hypotheses. By following eight weeks intervention, study demonstrated

integrated online quizzes formative assessment is a powerful strategy to enhance cognitive engagement (ownership of learning) of distance learners at university level. The results present significantly enhancement in the cognitive engagement of distance learners in online learning environment. The gain of metacognition is 2.70 points, similarly, gain of strategic learning is 5.02 points, persistence level is 1.86 points, and intrinsic motivation level is 5.36 points. The gain of each sub-construct of cognitive engagement demonstrate online quizzes as a formative strategy has transformed the learning process into an active, self-regulated cycle. This strategy achieved these gains by enabling learners to track progress, recognize gaps, and set focused learning goals. Their features (mode, themes, dashboard, easy login, and points) enabled them to monitor their performance and identify knowledge gaps. Their continuous performance evaluation, and feedback assisted to refine study strategies (organizing, and summarizing content) for achieving a set goal. Furthermore, supportive nature of the feedback, and post-discussion (activities) also helped them to clear misconceptions and mitigate frustration which increased their persistence level. These associated activities also fostered their intrinsic motivation by providing sense of autonomy and competence through flexible attempts, and a clear progress indicators resulting in transforming an online environment into a deeply engaging learning space. To show the practical application of the findings, Figure 3 presents the effect sizes of each sub-construct of cognitive engagement, representing robustness of integrated online quizzes as a formative assessment strategy intervention. Table 3 shows effect sizes of construct of cognitive engagement to demonstrate study's findings practical application.

Table 3

Effect Sizes of Cognitive Engagement Sub-constructs

Sr.	Gain	SD	Cohen's d Effect Size
1	2.70	2.03	1.3
2	5.02	4.20	1.1
3	1.86	1.39	1.3
4	5.36	4.97	1.0

It shows effect size of metacognition is 1.3. Similarly, strategic learning size is 1.1, persistence level 1.3, while intrinsic motivation level 1.0. These show large sizes, which present integrated online quizzes as a formative assessment strategy is significantly impactful in real world classroom setting.

Discussion

The central objective of investigation was to assess cognitive engagement of learners who were enrolled in MPhil academic degree from diverse locations. The present study's results demonstrated significant improvement in their cognitive engagement through online quizzes as a formative assessment strategy over 8 weeks. The outcomes accepted the hypotheses on the basis of empirical evidences (Johnson & Chen, 2021). Likewise, an existing study of Pearson (2024) explored learners engagement in three domains (cognitive, affective, behavior) with written feedback in second language. The study showed that learners' cognitive responses are essential to determine the effectiveness of feedback that they gained. This finding supports present study's result as learner's responses in online quizzes as a formative assessment strategy were crucial to identify their knowledge gaps. A study of Lam et al. (2024) investigated information, and communication technology tools support learners' engagement in formative assessment. It was presented these tools essential especially in engineering tasks, which provide evidences of their understanding, and lead them towards deep cognitive tasks.

The outcomes of the study support, online quizzes by using 'Quizizz' boost distance learners' active engagement and, lead mastery in content.

A study of Kew and Tasir (2021) analyzed learner's cognitive engagement by e-learning discussion forum through using content analysis. The objective of the study was to examine the relationship between student's demographics, participation frequency, and cognitive engagement levels. It has used asynchronous and e-discussion forum at university level. The outcomes showed responses reflect low level cognitive ability as they provided responses without adequate explanation. In contrast, present study investigated cognitive engagement of learner by using online quizzes. The results demonstrated their reinforcement in online quizzes as a formative assessment assisted to understand the complex concept of specific topic. Their appropriate responses in online quizzes showed they answered each question appropriately. Existing study of Man et al. (2023) designed assessment, which enhanced intellectual effort, and deep learning strategies. It followed high order thinking strategies using 'Webb's Depth of Knowledge levels' as learners solved real-world problems that promoted their deep application of knowledge. The findings supports to present study's outcomes as it has designed online quizzes as a formative assessment strategy that motivated distance learners to set a specific goal, adapt organization, and summarization strategies for achieving a goal. The adaptation of strategies led them for achieving better learning outcomes. A study of Lu et al. (2024) investigated real world contexts in project-based learning by using mix method design on undergraduate learners. The findings demonstrated real-world context in a project-based learning resulted in higher cognitive engagement (integrative, and higher-order learning) compared to a non-real-world context. Learners were prompted to apply their knowledge, and simplify complex information. It context promotes present study's findings as short questions answers were scenario-based in online quizzes which enhanced their cognitive engagement as a strategy.

Similarly, alignment of present study's findings with an existing study Mohammadi et al. (2025) showed improvement in learner's agentic engagement by using formative assessment in online learning environment. The agentic engagement was learners' activeness and shaping their learning process critically. The present study presents enhancement in distance learner's cognitive engagement through the use of integrated online quizzes as a formative assessment strategy in online learning environment. Cognitive engagement is associated with learners' sustained attention, strategic learning, and metacognition in academic tasks; intrinsic motivation facilitates this process. A study of Chen et al. (2025) meta-analyzed cognitive presence in online learning environment at university level. The study found that cognitive presence is the crucial predictor of academic success. It promotes present study's outcomes as online quizzes led them in achieving high learning outcomes. Online quizzes as a formative assessment strategy provided them strong, and weak areas of learning before final evaluation. Existing study of Pujiati et al. (2024) found the utilization of interactive game-based quiz significantly improved learner's performance in academic course. This finding supports present study results as interactive elements of online quizzes such as modes, theme, points, dashboard, easy login, and rewards encouraged their active participation in online quizzes. This activeness led them towards content mastery and, high academic performance in summative evaluation.

Prior study of Sleiman and Haddad (2024) found the use of Kahoot in foreign language course. It demonstrated consistent students' engagement, and enthusiasm through the use of Kahoot in learning process. The findings support to present study results as distance learners' show consistent active engagement in online quizzes as a formative assessment strategy. A study of Jankovic et al. (2025) demonstrated the use of game-based quizzes increased learners' weekly performance, which enhanced their high academic performance in mid-term, and final exams in university course. By comparing study's results with existing literature, the study suggest the use of integrated online quizzes through the widely used website 'Quizizz' within

an online learning environment effectively enhance cognitive engagement of learners. These results contrast the low cognitive ability found in passive online responses and, supports the call for assessments that enhance intellectual effort. Functionally, the active nature of the quizzes aligns with the principle; an active task following passive content stimulates cognitive investment, acting as an essential tool or strategy to compel the ‘evidence of understanding’ necessary for deep cognitive.

Limitations

While this study addresses a notable gap in the existing literature, it is subject to several limitations. First, the sample of 28 learners was drawn exclusively from a single course at one university, which may restrict the generalizability of the findings to other academic contexts, courses, or populations. Second, a 8 weeks period was chosen to provide sufficient empirical evidence for the study (McCormack et al., 2022).

Conclusion

The study concluded that integrated online quizzes, when utilized as a formative assessment strategy foster distance learners’ metacognition, who actively participate in online quizzes as a formative assessment strategy. Its support their persistence, and intrinsic motivation levels; encouraged them to set a specific learning goal, and invest cognitive effort for achieving it. Learning strategies such as organization, and summarization also assist learners for achieving set goals effectively. This cyclical process attracts their attention towards deep learning rather shallow learning. In addition, distance learners were willing to participate in every online quizzes by considering essential activity of online classes. While, paper-based quizzes as a formative assessment lead them towards excessive workload, and distress. The reason was behind that they needed proper time for attempting them, which lack during job hours. These findings offer valuable insights to policymakers, and teachers to grasp the concentration of postgraduate learners towards deep learning by boosting their cognitive engagement. This presents quality of online learning environment at university level.

Recommendations

On the basis of findings, the study recommends to future researcher;

1. It is an effective learning strategy; a teacher can use it as a diagnostic tool for understanding learners’ knowledge gaps. This identification assist to diagnose mostly learners’ show same mistakes in a specific concept. Associated instant constructive feedback with the strategy can reduce these concepts’ doubts.
2. This strategy provides an opportunity for learners to share their tasks experience with a teacher, and peers which can make an engaging environment. Thus, it courage them to pay close attention on their given responses.
3. Integrated online quizzes as a formative assessment strategy provides deep learning to learners as they actively engage in online quizzes reinforcement, which can lead concept mastery. It encourage them to connect new information with previous knowledge; apply and, develop information in different situations.
4. The learner’s final exams scores improve by using integrated online quizzes as a formative assessment strategy. As online quizzes clear learner’s concepts errors immediately, and promote such learning strategies which lead them towards high academic performance. As their results on dashboard, and associated feedback allow them to focus on weak areas to increase their summative scores.
5. This strategy cultivates intrinsic motivation of learners who enroll in primary, elementary, secondary, and post-graduate levels. It provides elements such as modes,

themes, points, time, easy login, and dashboard which capture their active attention towards effective learning. Elements of online quizzes such as time, and points create a sense of play which effectively capture their attention. A dashboard provides visual record of their journey. An easy login in online quizzes mitigates their frustration. The different assessment modes, and themes serve them as teaching autonomy.

6. This strategy intrinsically motivates learners to persist in academic career despite learning challenges raise. Associated activities with this strategy such as discussion, and feedback immediately correct their concepts doubts that lead better learning outcomes in next tasks. This small achievement motivates them to persist rather drop out from a semester.

Scope of the Study

1. The study recommended that effect should be investigated on large sample size by selecting a true basic experiment design in face-to-face classes. A large sample provides more practical validity of the integrated online quizzes as a formative assessment strategy.
2. This strategy should integrate diverse learning activities according to level of learners (primary, elementary, secondary, post-graduate) to capture their active concentration towards those subjects which require concept mastery (e.g math, science, english, research-oriented subjects). These activities may be concept mapping (to connect ideas), reflection (to identify learning challenges and gains), think-pair-share (to encourage collaboration) and peer assessment (where students design quizzes for reinforcement). These activities associated with online quizzes foster a more interactive learning environment leading to enhance student engagement.
3. Future studies should utilize different formats of online quiz like multiple-choice questions (MCQs), it is preferred format at all levels (Al-Shamrani et al., 2023). Specifically, studies should investigate postgraduate learner's aspects by using this format. Other types of assessment/quizzes such as picture descriptions, drag-and-drop, fill-in-the-blanks, matching, and labelling in Quizizz should be selected at the primary, elementary, and secondary levels for measuring the learning outcomes and fostering deep thinking of learners.
4. By using 'Quizizz' future researcher should investigate, explore and examine learners' responses through video, poll, audio response, word cloud, draw. These options of the website to record responses provide assist to a teacher to handle different learning styles in classrooms. Further, a teacher understands their digital literacy, communication skills, creativity, reflective thinking. By understanding these advanced skills a teacher well design online quizzes formative assessment strategy.

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