Evaluating the Impact of Online Formative Assessment on Student Performance and Perceptions: A Quasi-experimental Study From Saudi Higher Education

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Abstract

This quasi-experimental study explores the impact of online formative assessments (OFA), specifically through frequent online quizzes, on learning outcomes and student perceptions in an introductory computer education course at a Saudi Arabian university. The research involved 28 female students, divided equally into an experimental group (weekly online quizzes in addition to standard exams) and a control group (midterm and final exams only). Learning performance was measured using pre- and post-tests, while student perceptions were gathered through a structured questionnaire. Although post-test scores did not significantly differ between groups, the experimental group showed marked improvement from pre- to post-test, suggesting a positive effect of frequent quizzing on learning progression. Furthermore, students in the experimental group reported favorable perceptions of the quizzes, viewing them as helpful tools for reinforcing understanding and preparing for exams. This study contributes to the growing body of research on formative assessment by highlighting how the integration of OFA with self-regulated learning principles can promote learner autonomy and engagement—particularly within underrepresented higher education contexts such as Saudi Arabia. By bringing attention to the pedagogical value of continuous assessment in diverse cultural and institutional settings, the findings invite broader international dialogue on inclusive, context-aware strategies for enhancing student learning. Limitations include the small sample size and single-institution scope. Future research should involve larger, more diverse cohorts and examine the long-term impact of such assessment strategies across different disciplines and learning environments.

Keywords: online formative assessment, e-learning, frequent quizzes, higher education, self-regulated learning

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Introduction

Enhancing the quality of learning and teaching in higher education is a continuous pursuit for professors and administrators (Gokcora & DePaul, 2018). Assessment plays a crucial role in this mission, serving as a natural component of the learning process (Andriamiseza, 2022; Baleni, 2015). Miller et al. (1998) categorized assessment in higher education into three primary types: diagnostic, formative, and summative. Although commonly grouped under the umbrella term "assessment," each type has differs in purpose and application (Northern Illinois University Center for Innovative Teaching and Learning [NIU-CITL], 2012). Diagnostic assessment helps identify students' current knowledge, skills, and misconceptions before teaching. Formative assessment offers feedback during instruction, measuring both student and instructor progress. Summative assessment occurs after learning, providing a summary of teaching and learning outcomes, as no formal learning usually takes place at this stage (Miller et al., 1998; NIU-CITL, 2012).

Formative assessment, referred to as "assessment for learning" (Centre for Education Research and Innovation [CERI], 2008), has been recognized as essential for improving teaching effectiveness, motivating students, and enhancing learning outcomes (Andriamiseza et al., 2023; Liao et al., 2024; Shao et al., 2024; Xiao et al., 2023). The essence of formative assessment lies in providing teachers and learners with constructive feedback that guides them toward achieving learning objectives (Andriamiseza, 2022). Morris et al. (2021) conducted a systematic review on the influence of formative assessment and feedback on university students' academic performance. Their findings underscored the role of feedback in education and its positive impact on the learning process.

Leveraging online formative assessments (OFA) is an effective strategy to address the growing student population in higher education, as it helps manage the increasing demand while maintaining and enhancing the quality of teaching and learning (Andriamiseza, 2022; Andriamiseza et al., 2023). OFA provides teachers with valuable feedback to adjust instructional methods and offers students immediate feedback for monitoring and enhancing their own learning progress (Mahanan et al., 2021; Morris et al., 2021; Ryan, 2024). Moreover, OFA has proven effective in promoting student engagement and improving learning performance (Chen et al., 2021; Sotola & Crede, 2021; Zainuddin et al., 2020).

Given these findings, further investigation into the implementation of OFA and their impact on learning performance and student perceptions could yield valuable insights into teaching and learning practices in higher education. Wellington et al. (2015) suggest using online quizzes tailored to university and college levels to address short-term learning delays within a semester. Similarly, Chen et al. (2021) advocate for controlled experiments to evaluate the effects of formative assessments, such as frequent quizzes and tests, on student engagement and learning outcomes across different learning settings. Sartain and Wright (2020) emphasize expanding research across diverse geographic contexts to capture broader demographic variations. Mahanan et al. (2021) also recommend developing online assessment tools that evaluate practical skills and enhance the effectiveness of OFA across STEM disciplines in higher education.

In Saudi higher education context, Almossa and Alzahrani (2022) examined assessment practices among faculty and found a decline in formative assessment usage, despite frequent feedback and alignment with learning objectives. The study also reported that most instructors rely heavily on summative assessments, such as midterm and final exams, in line

with Ministry of Education regulations that assign 40% of grades to final exams and 60% to mid-term exams and coursework.

Building on these insights, this study explores the impact of OFA, specifically through frequent online quizzes, on students' learning performance and perceptions in a computer education course in Saudi higher education. The main research question is: *What is the impact of online formative assessments, specifically online frequent quizzes, on student learning performance and perceptions in higher education?* Findings of this study are expected to help educators make informed decisions, adjust instructional strategies, refine curricula, and provide targeted support to students, thereby promoting effective and evidence-based teaching practices in higher education.

Literature Review

Formative vs. Summative Assessments

Assessment plays a crucial role in understanding how students learn and determining whether teaching methods effectively achieve intended learning outcomes (Morris et al., 2021). Summative assessment evaluates student learning against specific standards, while formative assessment provides instructors with ongoing feedback to assess the effectiveness of their teaching and helps students monitor their own learning progress (Eberly Center [EC], 2024). Both types assess students' performance, yet they differ in purposes: summative assessment focuses on evaluating learning outcomes, while formative assessment aims to facilitate learning processes. Summative assessment typically covers a broader scope of student learning compared to formative assessment (Mahanan et al., 2021).

On the one hand, summative assessment is designed to evaluate and measure students' overall understanding and performance at the end of an instructional period, such as a semester or academic year. Midterm and final examinations are commonly used summative tools, as they assess students' cumulative knowledge and skills gained throughout the course (CERI, 2008; NIU-CITL, 2012). On the other hand, formative assessment is an ongoing process including frequent, interactive assessments of students' development and understanding, with the goal of identifying learning needs and adjusting instruction accordingly (CERI, 2008). This approach provides continuous feedback and information during instruction, facilitating both the monitoring of student progress and the evaluation of teaching effectiveness (NIU-CITL, 2012). Notably, these activities typically carry minimal or no grading weight and may not directly influence a student's final grade (NIU-CITL, 2012; EC, 2024).

Traditional assessment methods, such as midterm and final exams, remain prevalent due to their cost efficiency and ease of grading (Sotola & Crede, 2021). However, such summative assessments offer limit insight into the learning process, restricting opportunities for students to apply newly acquired knowledge. In contrast, formative assessment emphasize ongoing learning, helping identify gaps and misconceptions before final evaluations. It provides students with opportunities to practice skills and test their understanding without the pressure of grades (CERI, 2008; NIU-CITL, 2012; Morris et al., 2021). However, data gathered from summative assessments can serve a formative purpose when students or faculty use the results to inform in future instruction or guide learning strategies (EC, 2024).

The Role of Online Formative Assessment in Higher Education

OFA is defined as "all the processes involved in obtaining information about students' learning output to improve learning through giving timely feedback within a web-based learning environment" (Mahanan et al., 2021, p. 53). Different terms have been used to describe OFA, including e-formative assessment, formative e-assessment, web-based assessment, web-based assessment for learning, and online assessment for learning (Mahanan et al., 2021). Despite differences in terminology, all refer to integration of technological tools or platforms to facilitate assessment process (Sudakova et al., 2022). Digital technology plays a crucial role in creating effective, efficient, and secure assessments that advance student education (Ryan, 2024).

OFA offers several advantages, contributing to a more dynamic and responsive approach to teaching and learning. It is beneficial for both students and teachers. For teachers, OFA reduces grading time and administrative workload associated with recording and compiling marks (Baleni, 2015; Mahanan et al., 2021; Pishchukhina & Allen, 2021; Sotola & Crede, 2021). This efficiency allows educators to allocate more time to teaching, providing feedback, and addressing individual learning needs, thereby promoting a more productive classroom environment. Additionally, OFA enables continuous monitoring of student progress, helping instructors to identify areas of strength and weakness and to modify their teaching strategies accordingly (Mahanan et al., 2021; Pishchukhina & Allen, 2021).

Meanwhile, students benefit from OFA through prompt and comprehensive feedback, facilitating uninterrupted learning compared to traditional classroom-based methods (Baleni, 2015; Mahanan et al., 2021; Morris et al., 2021; Pishchukhina & Allen, 2021). For students, this ongoing feedback promotes reflection on their own learning, encourages active engagement, and supports timely intervention to enhance understanding and academic performance (Mahanan et al., 2021; Pishchukhina & Allen, 2021). OFA offers numerous advantages for students, including increased engagement and motivation (Chen et al., 2021; Dalby & Swan, 2018; Shao et al., 2024; Sotola & Crede, 2021; Wellington et al., 2015; Xiao et al., 2023; Zainuddin et al., 2020), flexibility in assessments timing and location (Baleni, 2015), and ongoing support for learning (Bostrom & Palm, 2024; Xiao et al., 2023). It also helps reduce test anxiety (Sudakova et al., 2022), promotes consistent attendance (Gokcora & DePaul, 2018), and fosters creativity (Shao et al., 2024). Furthermore, OFA promotes knowledge retention (Lubrick & Wellington, 2022; Sotola & Crede, 2021) by providing continuous opportunities to review and apply concepts, thereby preparing students more effectively for summative assessments. This preparation builds students' confidence and competence, leading to improved performance in midterms and final examinations (Sartain & Wright, 2020). Moreover, effective OFA supports a student-centered learning environment by offering personalized formative feedback and promoting meaningful engagement with course content (Baleni, 2015; Morris et al., 2021).

OFA has been implemented in higher education through various methods, including discussion forums, tasks, quizzes, and tests (Baleni, 2015; Chen et al., 2021; Gokcora & DePaul, 2018; Lubrick & Wellington, 2022; Pishchukhina & Allen, 2021; Wellington et al., 2015; Zainuddin et al., 2020). Among these, quizzes are widely used in university courses, providing rapid and immediate feedback that support formative learning (Chen et al., 2021; Gokcora & DePaul, 2018; Lubrick & Wellington, 2022; Mahanan et al., 2021; Pishchukhina & Allen, 2021). Sotola and Crede (2021) conducted a meta-analysis examining the impact of frequent quizzes on students' academic performance and found that in-class quizzes serve as

valuable teaching aids, moderately enhancing both performance and learning outcomes. Quizzes enable instructors and students to monitor comprehension, predict final exam achievement, and may contribute to lowering dropout rates. Furthermore, Gokcora and DePaul (2018) noted that frequent quizzes encourages regular class attendance and fosters productive learning habits that establish a more engaging learning experience.

Theoretical Framework

This study is grounded in the theory of self-regulated learning (SRL), which emphasizes learners' active role in directing and managing their own learning processes. SRL theory posits that students who actively assess and monitor their learning strategies develop stronger autonomy and a deeper sense of ownership over their educational outcomes (Cain & Fanshawe, 2020; Pishchukhina & Allen, 2021). Integrating OFA through frequent quizzes supports these process by enabling students to assess their understanding, receive immediate feedback, and make timely improvements. In this study, OFA is viewed as a mechanism to enhance students' self-efficacy and metacognitive skills, empowering them to understand and apply feedback effectively. This approach redefines teacher and student roles towards fostering a student-centered environment where self-assessment and continuous and immediate feedback play pivotal roles in improving learning performance (Pishchukhina & Allen, 2021).

Methodology

This study employed a quasi-experimental design to examine the impact of OFA, specifically frequent online quizzes, on students' learning performance and perceptions. The design included experimental and control groups, with both groups completing pre- and post-tests to compare performance before and after the intervention.

Research Context

This study was conducted in the female section of King Saud University (KSU) in Riyadh, Saudi Arabia, where classes are taught by female instructors in person or by male instructors through closed-circuit television or virtual classrooms. All KSU students use the university's learning management system (LMS), Blackboard, which supports on-campus learning by enhancing student engagement and academic performance. The research took place in an undergraduate computer education course during the second semester of 2023 academic year, spanning 16 weeks. The course included weekly 60-minute sessions focusing on technology-enhanced learning and fundamental teaching aspects. The course had 32 female students, most in their first or second year (KSU-Statistics, 2023).

Participants

The study included 28 female students enrolled in two classes, both taught by the same instructor. The classes were randomly assigned to an experimental group (n = 14) and a control group (n = 14). The control group, referred to as the "non-quizzing" group, followed a traditional summative assessment approach consisting of two midterm exams and a final exam. In contrast, the experimental group, or the "quizzing" group, completed the same summative assessment but also participated in twelve online quizzes administered throughout the semester as formative assessment. These quizzes were designed to provide continuous feedback, encourage consistent study habits, and support self-regulated learning.

Research Instruments

The study employed two quantitative instruments: pre- and post-achievement tests to assess and compare learning performance between groups, and a structured questionnaire to examine the experimental group's perceptions of the online frequent quizzes.

Achievement Evaluation

Examinations and achievement tests are recognized tools for evaluating students' knowledge, proficiency, and learning performance in a subject or educational program (Hanif et al., 2017; Mamolo, 2021). Therefore, a 30-item multiple-choice achievement test was developed for this study, accompanied by an answer key for standardized grading. The questions were evenly distributed across the main topics covered in the course to ensure balanced content representation. Both the pre-test and post-test were administered using an online survey platform (Google Forms).

Ensuring the validity and reliability of the test was a key consideration. Validity refers to the degree to which an instrument accurately measures the intended construct (Creswell & Creswell, 2018) and can be established through careful item development, sampling, and expert review (Basit, 2010). To confirm content validity, five faculty members who taught similar computer education courses reviewed the test, and their feedback was incorporated to refine and adjust the items as needed. Reliability, which indicates the consistency of test results under comparable conditions (Creswell & Creswell, 2018), was examined using the Spearman–Brown prophecy formula. The resulting reliability coefficient (rSB = 0.692) was deemed acceptable for research purposes.

Perceptions Questionnaire

The perceptions questionnaire was developed based on a review of relevant literature (Chen et al., 2021; Gokcora & DePaul, 2018), which provided theoretical and empirical foundations aligned with the focus of this study. Insights drawn from the literature guided the formulation of the questionnaire items to ensure relevance and construct alignment.

The questionnaire, written in Arabic, comprised 20 statements designed to capture students' perceptions of online quizzes. It was divided into four sections: (1) perceived usefulness of frequent quizzes for learning (6 items), (2) effectiveness in exam preparation (4 items), (3) quiz design and structure (4 items), and (4) overall experience and approach to online quizzing (6 items). Responses were collected using a five-point Likert scale ranging from "strongly agree" (SA) to "strongly disagree" (SD).

To ensure content validity, the instrument was reviewed by the same five faculty members who evaluated the achievement test, and their feedback was used to refine the wording and clarity of the items. For reliability, a pilot version of the questionnaire was administered to a representative sample of students to confirm comprehension of items and response options. Minor revisions were made based on their feedback, and these participants were excluded from the main study sample.

Online Frequent Quizzes Format

The online quizzes for the experimental group were tailored to the specific course content and administered via the LMS at the start of each class. The LMS was chosen for its accessibility through the university's website and mobile app, and its ability to provide immediate, detailed feedback. Each quiz lasted about 5–10 minutes and included around ten multiple-choice, true/false, or short-answer questions focused on the topics and skills from the previous lecture to reinforce learning and maintain content continuity.

Following each quiz, students received an automated score indicating the number of correct answers, accompanied by immediate written feedback that clarified any misunderstandings or misconceptions that could hinder their learning progress. The quizzes, designed as a formative assessment tool, provided students with valuable insights into their level of understanding while offering instructors diagnostic information about areas of confusion and difficulty. This dual function enabled students to track their performance and allowed instructors to adjust instructional strategies to target specific learning challenges. On average, students achieved a mean score of 69%, with approximately 62% obtaining full marks.

Study Procedures

The study began with a pre-test administered for both the control (non-quizzing) and experimental (quizzing) groups to assess their prior knowledge. Throughout the semester, both groups received lecture-based instruction, used the university's LMS (Blackboard) to complete course requirements, and took three paper-based summative exams: two midterm exams and one final exam. In addition, the experimental group completed twelve online quizzes, one each week beginning in the second week of the semester. These quizzes were not scheduled during exam weeks and remained accessible on the LMS throughout the term, allowing students to review and revisit them as needed.

At the end of the semester, both groups completed a post-test to evaluate their learning performance. The experimental group also completed a perceptions questionnaire regarding the frequent online quizzes. The questionnaire was administered anonymously through Google Forms, and students were given time during class to complete it to ensure high response rates. Figure 1 displays the LMS page showing the weekly quizzes for the experimental group, while Figure 2 provides an example of one of the online quizzes.

Figure 1

The LMS Frequent Quizzes Page for the Experimental Group

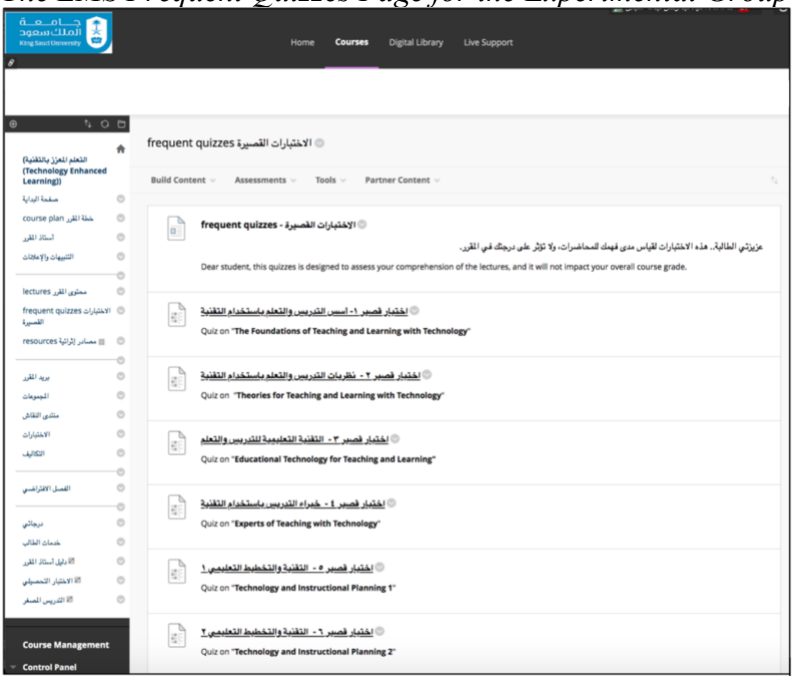
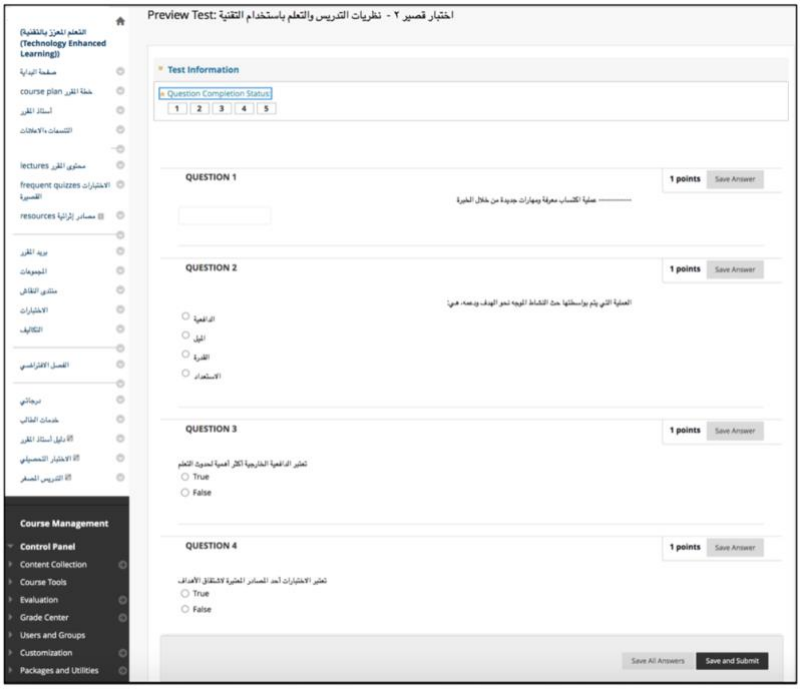


Figure 2

Example of A Frequent Online Quiz in LMS for the Experimental Group



Data Analysis

Descriptive and inferential statistical analyses were used to evaluate the achievement test data. Mean (M) and standard deviation (SD) were calculated to describe the data. Independent samples t-tests were conducted to compare pre-test and post-test scores between the experimental and control groups, while paired samples t-tests were used to examine within-group differences. All analyses were performed using SPSS software.

For the perceptions questionnaire, descriptive statistics were applied to analyze the experimental group's responses regarding the online frequent quizzes. Data collected via Google Forms were exported to SPSS, which computed frequencies, percentages, means, and standard deviations for each item.

Ethical Considerations

Ethical research approval to conduct this study was granted from the Ethics of Human and Social Research Committee at KSU (KSU-HE-24-672). In accordance with the ethical research guidelines proposed by Petousi and Sifaki (2020), informed consent was obtained from all participants prior data collection. Participants were assured of the anonymity and confidentiality of their responses and informed of their right to withdraw from the study at any stage without the need to provide justification.

Results and Discussion

Impact of OFA on Students' Learning Performance

An analysis of students' prior knowledge was conducted to determine whether any initial differences existed between the groups. As shown in Table 1, the results of the pre-test indicated no statistically significant differences between the two groups, confirming that they possessed comparable baseline knowledge of the course content. At the end of the treatment period, the post-test analysis also showed no significant difference in mean scores between the groups. Both groups achieved relatively high scores, with only minor variations in learning performance.

Table 1
Independent Samples t-Tests for Experimental vs. Control Groups in Achievement Tests

Test	Group	n	M	SD	T	P
Pre-test	Control Group (non-quizzing)	14	17.4285	3.7357	0.6928	0.4946*
	Experimental Group (quizzing)	14	16.5000	3.3454		
Post-test	Control Group (non-quizzing)	14	17.9285	4.1410	-0.9281	0.3619*
	Experimental Group (quizzing)	14	19.5714	5.1696		

* By conventional criteria, this difference is considered to be not statistically significant.

To clarify the study's results, paired samples t-tests were conducted to examine within-group changes between pre- and post-test scores for both groups, as presented in Table 2.

Table 2
Paired Samples T-tests Comparing of Pre-test and Post-test Scores for Both Groups

Group	Test	n	M	SD	T	P
Control Group (non-quizzing)	Pre-test	14	17.4285	3.7357	0.5838	0.5693*
	Post-test	14	17.9285	4.1410		
Experimental Group (quizzing)	Pre-test	14	16.5000	3.3454	2.3058	0.0382**
	Post-test	14	19.5714	5.1696		

* By conventional criteria, this difference is considered to be not statistically significant.
** By conventional criteria, this difference is considered to be statistically significant.

The analysis of the data in Table 2 showed no statistically significant difference at the 0.01 level between the pre-test and post-test scores for the control (non-quizzing) group. In contrast, the experimental (quizzing) group demonstrated a statistically significant improvement, suggesting that the use of online frequent quizzes contributed to the enhancement of students' learning performance. This finding is consistent with previous studies such as Dalby and Swan (2018) and Zainuddin et al. (2020), which similarly reported that frequent quizzes can support higher academic performance and skill development. However, it is important to note that Atia et al. (2018) found that frequent quizzes did not yield consistent benefits across all settings, indicating that factors such as instructional context, quiz design, and implementation strategies may influence their effectiveness.

Impact of OFA on Students' Perceptions

The study revealed that experimental group students agreed that the online frequent quizzes positively contributed to their learning process, provided an engaging and stimulating learning experience, and were an effective method for understanding the course content. They also felt that the quizzes met their learning needs, motivated them to be more attentive during lectures, and facilitated the completion of course requirements, such as in-class activities and homework. Table 3 shows the descriptive statistics for the first section of the perception questionnaire, with an overall mean of 4.48, indicating a positive view on the usefulness of online frequent quizzes for enhancing course learning. These results concur with Gokcora and DePaul (2018), who discovered that frequent quizzes encourage students to attend classes more consistently and create a productive classroom routine that promotes positive learning behaviors.

Table 3
Students' Perception of the Effectiveness of Online Frequent Quizzes in Improving Course Learning

How strongly do you agree with these statements? (5= Strongly Agree, 4= Agree, 3= Neutral, 2 = Disagree, 1 = Strongly Disagree)	M	SD
Q1: The online frequent quizzes in this course are aligned with my learning needs.	4.50	0.732
Q2: The online frequent quizzes in this course offer an engaging and stimulating learning experience.	4.57	0.631
Q3: The online frequent quizzes in this course contribute to my learning process.	4.57	0.631
Q4: The online frequent quizzes in this course proved to be an effective method for comprehending the course content.	4.57	0.739
Q5: The online frequent quizzes in this course help me fulfill the course requirements easily (e.g., in-class activities, homework).	4.21	0.833
Q6: The online frequent quizzes in this course motivate me to pay closer attention during lectures for successful completion	4.50	0.732
Mean	4.48	

In terms of the effectiveness of online frequent quizzes for exam preparation, students expressed agreement that the quizzes were advantageous for reviewing course material before

exams. They reported that the quizzes helped save time and effort compared to other regular courses and offer valuable exam practice opportunities that contributed to increased confidence during exams. Table 4 presents the descriptive statistics for the second section of the perception questionnaire, with an overall mean of 4.39, indicating a positive view of online frequent quizzes for exam preparation. The findings align with the view that OFA are effective for preparing students for summative assessments (Lubrick & Wellington, 2022; Sotola & Crede, 2021). Formative assessment enhances self-confidence in learning (Shao et al., 2024; Stitch, 2024) and helps build competence in the subject matter, which in turn improves performance in midterms and final exams (Gokcora & DePaul, 2018; Sartain & Wright, 2020).

Table 4
Students' Perception of the Effectiveness of Online Frequent Quizzes in Exam Preparation

How strongly do you agree with these statements? (5= Strongly Agree, 4= Agree, 3= Neutral, 2 = Disagree, 1 = Strongly Disagree)	M	SD
Q7: The online frequent quizzes in this course were beneficial for reviewing before exams compared to other regular courses (without frequent quizzing).	4.43	0.623
Q8: The online frequent quizzes in this course saved me time and effort in preparing for exams compared to other regular courses.	4.43	0.623
Q9: The online frequent quizzes in this course provided me with opportunities to practice for exams compared to other regular courses.	4.36	0.772
Q10: The online frequent quizzes in this course increased my confidence when taking exams compared to other regular courses.	4.36	0.772
Mean	4.39	

Additionally, students expressed favorable views on the design of the online frequent quizzes, finding them well-structured, clearly defined, and appropriately designed. They also deemed the online tool used for the quizzes as suitable and felt that the quizzes' length and frequency were appropriate. Chen et al. (2021) similarly found that students had positive perceptions of OFA, indicating that the instruction design was well-received. Table 5 presents the positive feedback from the experimental group students regarding the quiz design (the third questionnaire section), with an overall mean score of 4.30.

Table 5
Students' Perception on the Design of the Online Frequent Quizzes

How strongly do you agree with these statements? (5= Strongly Agree, 4= Agree, 3= Neutral, 2 = Disagree, 1 = Strongly Disagree)	M	SD
Q11: The length of the quizzes was suitable.	4.21	0.739
Q12: The frequency of the quizzes was appropriate.	4.21	0.641
Q13: The online tool used for the quizzes was suitable.	4.29	0.886
Q14: The quizzes were well-designed, clearly-defined and well-structured.	4.50	0.732
Mean	4.30	

Students' also expressed positive opinions of the online frequent quizzes approach, viewing it as an effective learning tool and supporting its use in other courses. They indicated willingness to enroll in courses that adopt a similar method. However, they remained neutral regarding whether the approach required excessive time and effort. Table 6 shows an overall mean of 4.19 for the last questionnaire section regarding the online frequent quizzes approach.

Table 6
Students' Perception of the Online Frequent Quizzes Approach as a Whole

How strongly do you agree with these statements? (5= Strongly Agree, 4= Agree, 3= Neutral, 2 = Disagree, 1 = Strongly Disagree)	M	SD
Q15: I found taking quizzes in this course to be engaging.	4.29	0.795
Q16: I found taking quizzes in this course to be enjoyable.	4.36	0.882
Q17: I would be open to enrolling in another course that employs the same frequent quizzes approach as this one.	4.36	0.882
Q18: The frequent quizzes approach used in this course would be beneficial to apply in other subjects.	4.43	0.729
Q19: The frequent quizzes approach is an effective learning method.	4.57	0.631
Q20: The frequent quizzes approach does not require excessive time and effort	3.14	1.5
Mean	4.19	

Overall, the study revealed that students in the experimental group expressed positive perceptions of OFA. Table 7 shows a mean score of 4.34 across all sections of the perception questionnaire, indicating a generally favorable view of the frequent online quizzes used in their computer education course. These findings are consistent with previous studies, such as Gokcora and DePaul (2018), Baleni (2015), and Chen et al. (2021), which reported that students appreciated frequent quizzes for their role in boosting confidence and understanding of course material.

Table 7
The Perception Questionnaire Mean Score

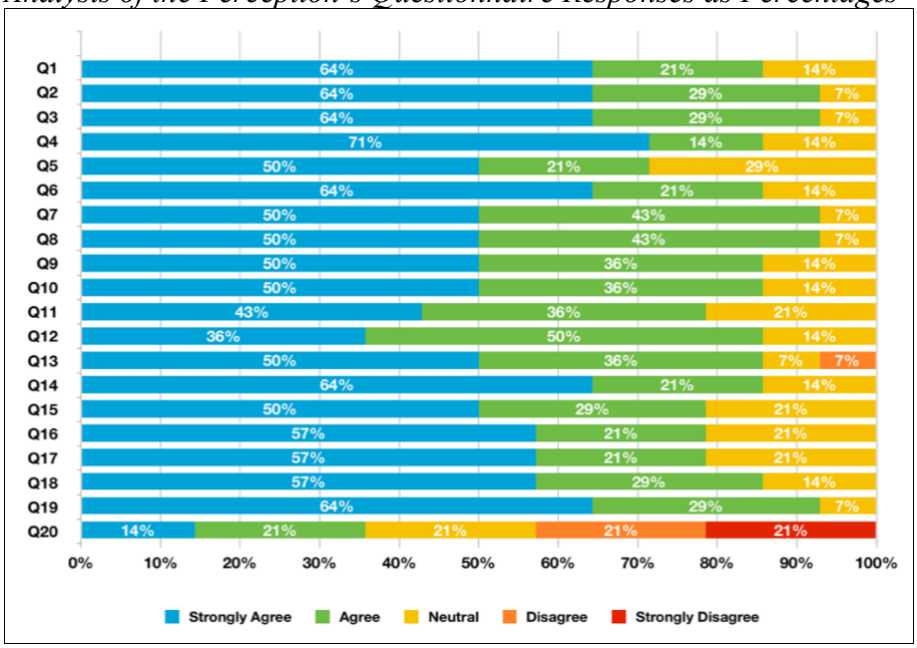
Sections of the perception questionnaire	no. of items	M
Section 1: the effectiveness of online frequent quizzes in improving course learning	6	4.48
Section 2: the effectiveness of online frequent quizzes in exam preparation	4	4.39
Section 3: the design of the online frequent quizzes	4	4.30
Section 4: the online frequent quizzes approach as a whole	6	4.19
Mean	20	4.34

Analysis of the perception questionnaire data showed that more than 82% of students in the experimental group responded with "strongly agree" or "agree" to the majority of perception items. However, one response was "disagree" for "The online tool used for the quizzes was

suitable," and six responses were "disagree" or "strongly disagree" for "The frequent quizzes approach does not require excessive time and effort," as illustrated in Figure 3.

Figure 3

Analysis of the Perception's Questionnaire Responses as Percentages



Conclusion

This study contributes the literature on formative assessment by examining the perceptions and performances of female students in Saudi higher education, a group that has been underrepresented in previous research. It provides evidence of how integrating SRL principles with OFA can support learning outcomes and encourage self-regulation in higher education settings that are transitioning towards more student-centered approaches. The findings also offers insights that may be relevant to similarly structured or underexplored educational contexts.

The integration of SRL theory with OFA has practical implications for teaching practices in higher education. SRL highlights the importance of students monitoring and managing their own learning (Cain & Fanshawe, 2020; Pishchukhina & Allen, 2021), which is facilitated by frequent quizzes that offer timely feedback. Online frequent quizzes, as a form of OFA, help students develop self-assessment skills, strengthen confidence, and take a more active role in their learning. For teaching practices, this approach supports a shift towards a student-centered model where quizzes function not only as assessment tools but also as ongoing sources of feedback and guidance. This shift aligns with current educational priorities in Saudi Arabia (OECD, 2020), supporting environments that promote engagement, self-efficacy, and personalized learning.

Methodologically, this study adds to existing knowledge by using a quasi-experimental design with pre- and post-tests, complemented by student perception data. This combination provides a broad view of both learning performance and student experiences. Conceptually, the study positions online frequent quizzes as more than assessment tools; as mechanisms that encourage metacognitive skills such as goal-setting and reflective thinking. This

perspective aligns with current directions in higher education, where active and technology-supported learning is increasingly emphasized.

To extend the global discussion on formative assessment, future research should investigate the long-term effects of frequent quizzes across different courses, disciplines, and cultural contexts. Further studies exploring various forms of formative assessment and their influence on both learners and instructors would deepen understanding of how these practices support SRL. Practically, integrating frequent quizzes can enhance self-regulation skills and improve learning outcomes when implemented systematically.

Despite its contributions, this study has several limitations, including a small sample from one institution, possible differences in student characteristics, and reliance on self-reported data. Addressing these limitations in future studies will provide a more comprehensive understanding of how online frequent quizzes influence learning and perceptions in broader educational settings and contribute to refining practices that support SRL.

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