INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN ECONOMICS & MANAGEMENT SCIENCES

OPEN ACCESS JOURNAL

Vol 15, Issue 2, (2026) E-ISSN: 2226-3624

Teacher Digital Literacy and Virtual Formative Assessment Quality in Bahraini High Schools: Bridging Policy Frameworks and Classroom Practices

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DOI Link: http://dx.doi.org/10.6007/IJAREMS/v15-i2/28275

Published Online: 14 May 2026

Abstract

This study investigates the relationship between teacher digital literacy and the quality of virtual formative assessment (VFA) in Bahraini high schools. Using a descriptive correlational design, data was collected from 400 teachers across private secondary institutions. Teacher digital literacy was measured through the European DigCompEdu framework, while VFA quality was assessed using the FAMT-Q tool. Results indicate that while digital literacy is statistically related to VFA quality, the correlations are weak, suggesting that digital competence alone does not strongly predict assessment quality. Regression analysis highlights the possibility that institutional and contextual factors, such as leadership, infrastructure, and policy supports, play a greater role in shaping VFA quality. Findings underscore a gap between progressive policy frameworks and classroom realities, pointing to the need for professional development and systemic support that move beyond individual competence. The study contributes to the growing literature on digital pedagogy by highlighting the importance of contextual adaptation in implementing digital assessment reforms.

Keywords: Teacher Digital Literacy, Virtual Formative Assessment, Digital Pedagogy, ICT Integration, School Leadership

Introduction

The global shift toward digitalization in education has reshaped the landscape of teaching and learning, emphasizing the importance of digital competencies among educators. In particular, teacher digital literacy has emerged as a critical determinant of instructional quality in virtual learning environments. As education systems increasingly integrate technology into the fabric of schooling, the role of teachers as digitally competent professionals is paramount. This is particularly true in the context of formative assessment, a pedagogical practice central to effective teaching and student-centered learning (Afzal & Rafiq, 2022). Formative assessment, when conducted virtually, necessitates a range of digital skills, ranging from the use of learning management systems to the deployment of interactive feedback tools, requiring teachers to not only adapt their pedagogical approaches but also rethink the design and delivery of assessment (Pellegrino & Quellmalz, 2010; Black & Wiliam, 2009).

In recent years, the Kingdom of Bahrain has made notable strides in advancing its digital education agenda. Anchored by Vision 2030 and a series of reforms under the National Education Reform Project, Bahrain aims to position itself as a knowledge-based society by promoting digital innovation across various sectors, including education (Economic Development Board, 2021). These national ambitions have been translated into policies promoting the integration of ICT into classroom instruction and assessment. Nevertheless, challenges remain in aligning policy frameworks with classroom practices, particularly when it comes to teachers' ability to implement high-quality formative assessments in virtual settings. This alignment is not merely a matter of infrastructure or access to digital tools; it hinges on the professional capacity of teachers to make informed instructional and assessment decisions using digital technologies (Redecker, 2017).

Digital literacy for teachers extends beyond operational skills and encompasses the ability to critically evaluate, select, and apply digital tools in pedagogically meaningful ways (Rafiq, Zaki, & Nawaz, 2025). According to the European Commission's DigCompEdu framework, digital competence includes domains such as digital resources, teaching and learning, assessment, empowering learners, and facilitating learners' digital competence (Redecker, 2017). In the Bahraini context, existing professional development programs have tended to emphasize basic ICT skills rather than holistic digital pedagogy. This gap is particularly evident in formative assessment practices, where teachers often rely on traditional approaches that may not be suitable for virtual contexts (BQA, 2022). A digitally literate teacher, therefore, must be equipped to leverage technology not only to deliver content but also to design and interpret formative assessments that are responsive, inclusive, and data driven. The importance of formative assessment has been extensively documented in educational research. Black and Wiliam (2009) conceptualize formative assessment as an iterative process where evidence of student learning is used to adjust teaching and improve learning outcomes. In virtual learning environments, this process is mediated by digital tools that can automate feedback, enable real-time tracking of student progress, and support personalized learning trajectories (Herppich et al., 2018; Rafiq, Iqbal & Afzal, 2024). However, the quality of virtual formative assessment depends significantly on the teacher's digital and pedagogical fluency. In the absence of face-to-face cues and interactions, digital assessment practices must be intentionally designed to ensure clarity, engagement, and responsiveness. Teachers must make nuanced decisions about which digital tools to use, how to interpret assessment data, and how to provide timely and constructive feedback, all of which require advanced levels of digital literacy (Voogt et al., 2015).

Despite the policy emphasis on ICT integration in Bahrain, recent reports indicate a disconnect between the vision articulated at the policy level and the realities experienced by teachers in classrooms. The Bahrain Education & Training Quality Authority (BQA) has highlighted disparities in the availability of digital infrastructure, inconsistencies in teacher training, and varying levels of support across schools (BQA, 2022). Moreover, qualitative insights from teachers suggest that while digital platforms are available, they are not always used effectively for formative assessment due to limited training and support in pedagogical design. In this context, it is essential to understand how teachers interpret and implement national policies related to digital assessment, and how these interpretations shape their classroom practices. High schools, as institutions preparing students for higher education and the workforce, are particularly significant in this discourse. At this level, formative assessment

plays a crucial role in identifying learning gaps, preparing students for high-stakes exams, and fostering critical thinking and self-regulation (Rafiq, Khadim & Afzal, 2023). In a digital environment, this role is amplified but also complicated by factors such as students' varying access to technology, differences in digital fluency, and the challenges of maintaining engagement in virtual classrooms. Teachers are thus expected to perform multiple roles: as content experts, digital navigators, assessment designers, and feedback facilitators. The success of virtual formative assessment, therefore, is inextricably linked to the competencies and support systems available to teachers.

International literature offers valuable insights into the components of effective virtual formative assessment. For example, Pellegrino and Quellmalz (2010) argue that technology-enhanced assessments can offer richer data and more adaptive feedback than traditional methods. However, they caution that technology alone cannot improve assessment quality without skilled teachers who understand assessment principles and how to apply them digitally. Similarly, Herppich et al. (2018) highlights that while digital tools offer potential for innovation, the effectiveness of formative assessment ultimately depends on teachers' conceptual understanding of assessment and their capacity to integrate digital feedback into instructional planning. To bridge the gap between policy and practice, it is important to explore not only what teachers are expected to do, but also what they are actually able to do within their institutional contexts. This includes examining the adequacy of teacher preparation programs, the availability of continuous professional development opportunities, and the presence (or absence) of supportive school leadership. Leadership is especially important in fostering a culture that values experimentation, reflection, and collaborative learning, all of which are crucial for effective assessment practices (Darling-Hammond et al., 2017). In Bahrain, where the central education authority plays a significant role in shaping school operations, understanding these institutional dynamics is key to identifying enablers and barriers to effective digital assessment.

Literature Review

The literature surrounding teacher digital literacy and the quality of virtual formative assessments has grown substantially in the wake of the COVID-19 pandemic, which exposed the vulnerabilities and potentials of digital education systems worldwide. This shift has prompted extensive discourse on the digital competencies of teachers and their capacity to effectively use formative assessments in online or blended learning environments. Within the Middle East, and particularly in Bahrain, these issues intersect with national education reforms and technology-driven policy frameworks. In this review, the literature is synthesized across four thematic domains: (1) conceptualizations of digital literacy in teaching, (2) effectiveness and challenges of virtual formative assessments (VFAs), (3) policy-practice alignment in Bahrain and the region, and (4) pedagogical transformation and institutional readiness.

Conceptualizing Teacher Digital Literacy

Teacher digital literacy has evolved from basic ICT proficiency to a multifaceted construct encompassing pedagogical, technological, and assessment-related capabilities. The DigCompEdu framework by Redecker (2017) provides a widely accepted model, outlining six competency areas for educators: professional engagement, digital resources, teaching and learning, assessment, learner empowerment, and enabling learners' digital competence.

Within these domains, digital assessment literacy is particularly salient for virtual environments where teachers must not only navigate platforms but also design adaptive, interactive, and timely assessments. In the Middle East, a number of studies show that digital literacy remains uneven among educators. Alayyar et al. (2018) report that teacher training programs in the region often emphasize functional ICT use while neglecting pedagogical integration. Similarly, Mahmoud and Bawaneh (2025) observe that while many teachers in high school settings in Bahrain possess basic technological skills, they struggle to leverage them for formative feedback, particularly in synchronous virtual environments. These findings align with those of Zahid and AlManiam (2024), who underscore the need for targeted development in digital formative assessment strategies within Bahraini secondary schools.

Digital literacy is also influenced by teacher attitudes, beliefs, and experiences. Zainab El Sibai (2022) examined Lebanese middle school teachers' beliefs and found that their self-efficacy in digital formative assessment was strongly correlated with prior exposure to digital tools and institutional support. The study highlighted those beliefs about the usefulness of technology often dictated the depth of its pedagogical application. Teachers who were more confident in their digital literacy designed more interactive, student-centered assessments, while others defaulted to traditional, summative-like activities in virtual formats.

Virtual Formative Assessment: Effectiveness and Barriers

Formative assessment, by definition, involves continuous feedback loops that inform both teaching and learning (Black & Wiliam, 2009). In digital contexts, these assessments may include online quizzes, live polls, discussion forums, peer assessments, and data analytics. When properly implemented, VFAs can enhance learning outcomes, increase student agency, and support differentiated instruction (Pellegrino & Quellmalz, 2010; Mohsin, 2025). However, several barriers impede their effectiveness, particularly in contexts with variable teacher readiness and technological infrastructure.

In Bahrain, Zahid and AlManiam (2024) conducted an empirical study on the efficacy of VFAs at the high school level. Their findings revealed that while digital tools were widely available, many teachers lacked clarity on assessment objectives, leading to inconsistencies in feedback quality. Moreover, assessment practices were often misaligned with national curriculum standards, resulting in missed opportunities for data-driven instruction. Another regional study by Al Fraidan and Alaliwi (2024) focused on Saudi Arabia's digital education transformation and reported similar findings. The authors noted that although digital infrastructure had improved dramatically, formative assessments remained underutilized due to the persistence of exam-centric pedagogical models and a lack of professional learning communities to support reflective assessment practice. These findings suggest that digital access alone does not ensure the quality of formative assessment must be accompanied by pedagogical innovation and systemic support. Globally, researchers such as Zhang et al. (2024) have echoed these concerns, finding that teachers across the Middle East exhibited significant variability in formative assessment literacy. Their systematic review of K–12 EFL contexts showed that formative practices were often conflated with summative tests and lacked the dialogic and feedback-oriented qualities that define effective assessment. The study recommended the inclusion of digital formative assessment literacy in both pre-service and in-service teacher education curricula.

Policy Frameworks and the Practice Gap in Bahrain

The Kingdom of Bahrain has introduced several education policies under the umbrella of Vision 2030 that emphasize ICT integration, digital pedagogy, and quality assurance mechanisms (BQA, 2022). However, bridging the gap between national policy and classroom reality remains a persistent challenge. While frameworks exist on paper, implementation varies widely across schools due to differences in leadership, professional development access, and teacher buy-in. Escott (2023), in a case study conducted in the UAE, argues that national mandates often suffer from "implementation drift," where the original intentions of digital pedagogy are diluted during execution due to misalignment between stakeholders. Similar issues are noted in Bahrain, where teachers often report being overburdened with administrative expectations and under-supported in terms of technical and pedagogical training (Mutiah, 2019). The issue is compounded by hierarchical top-down governance structures in many Gulf states, where teachers have little input into policy design or curricular adaptation. Ait Mama (2025) notes that while internationalization efforts have brought more digital tools into classrooms across the MENA region, localized adaptations that reflect classroom realities are still missing. As a result, virtual formative assessments are often introduced as technical add-ons rather than integral pedagogical components.

Pedagogical Shifts and Institutional Readiness

Effective virtual formative assessment requires a pedagogical paradigm shift from content delivery to student-centered, reflective learning. This transition necessitates changes not only at the teacher level but also within broader institutional cultures. Leadership support, collaborative planning time, professional learning networks, and feedback systems are essential for fostering assessment innovation (Mehanna et al., 2023). Shannaq (2024) argues that digital formative assessment is not merely a tool but a transformative practice that requires rethinking the role of the teacher as a facilitator, assessor, and learning coach (Rafiq, Qaisar & Butt, 2022). In this model, digital tools serve as enablers of timely feedback, learner analytics, and differentiated instruction. However, transformation is contingent on whether teachers are encouraged to experiment, reflect, and learn collaboratively. Razzak (2022), in a post-COVID study of e-learning in Bahrain, found that while virtual platforms were quickly adopted during the pandemic, pedagogical quality suffered due to an overreliance on surface-level assessment tools. The study emphasized the importance of embedding formative assessment within instructional design, supported by sustained professional development and digital mentoring. Professional development programs tailored to assessment literacy and digital innovation are sparse across the Middle East. A systematic review by Al-Bahlani and Ecke (2023) on English language teachers in Oman revealed that most participants had no formal training in formative assessment theory or practice, and those who engaged in assessment largely relied on institutional templates without adaptation to learner needs.

Synthesis and Gaps

Currently, the literature makes a compelling case for integrating teacher digital literacy and formative assessment competence into policy and practice. In Bahrain and similar contexts, national visions have made commendable strides in promoting technology, but implementation challenges persist due to gaps in teacher training, assessment design literacy, and institutional readiness. Most critically, the disconnect between policy and pedagogical realities continues to undermine the potential of VFAs. Several gaps remain underexplored in literature. First, there is limited empirical research focusing specifically on high school settings

in Bahrain. Most studies tend to generalize across the MENA region or focus on high school. Second, the intersection of digital literacy, formative assessment, and school-level leadership remains insufficiently studied. Finally, few works evaluate the long-term impact of professional development initiatives on formative assessment quality in virtual environments.

This review, therefore, highlights the need for context-sensitive, teacher-informed research that explores how digital assessment policies are enacted in real classrooms. It also calls for investment in collaborative learning structures that enable teachers to share best practices, engage in inquiry-based reflection, and co-develop assessment tools suited to their students' needs. Only through such integrative efforts can the promise of digital formative assessment be fully realized in Bahrain's high schools and beyond.

Research Gap

Over the past decade, a growing body of literature has explored the integration of digital tools in education, particularly in relation to teaching practices and student engagement. However, there remains a notable absence of empirical studies that specifically investigate the relationship between teacher digital literacy and the quality of virtual formative assessment within high school contexts in Bahrain. While many international frameworks, such as DigCompEdu, have outlined the competencies required for educators in digital environments, these models are rarely localized or applied within Middle Eastern secondary school settings. Most existing research in the region tends to focus on high school or general ICT adoption, often neglecting the unique pedagogical demands of formative assessment in virtual classrooms at the school level. In Bahrain, national policies have emphasized digital transformation in education as part of Vision 2030, yet little is known about how these policies are interpreted and implemented by teachers, particularly with regard to formative assessment practices. Studies have indicated that although teachers may possess basic digital skills, they often lack the pedagogical literacy necessary to design and deliver effective formative assessments that are responsive, feedback-driven, and student-centered. Furthermore, institutional challenges such as limited professional development, inconsistent leadership support, and a lack of collaborative learning environments further complicate the ability of teachers to apply digital assessment strategies effectively. As a result, there is a significant gap in understanding how teacher digital literacy intersects with assessment quality and policy implementation in Bahraini high schools.

Research Problem

In Bahrain's pursuit of educational innovation and digital transformation, teachers are increasingly expected to utilize digital tools for instruction and assessment. However, the quality of virtual formative assessment practices remains uneven across high schools, revealing a critical challenge in the nation's educational landscape. Teachers are often required to conduct assessments in virtual environments without adequate training in digital pedagogy or assessment literacy, which leads to the use of superficial tools that fail to support meaningful learning outcomes. Although digital infrastructure and learning platforms are available in most schools, the pedagogical use of these tools for formative assessment is frequently underdeveloped. Teachers may rely on basic quizzes and closed-ended activities that do not provide rich, timely feedback or promote deeper cognitive engagement. Additionally, there is a clear disconnect between the aspirations outlined in national education policies and the practices observed in classrooms. Teachers report being

overwhelmed by administrative demands and lacking sufficient institutional and professional support to engage in high-quality assessment practices. This situation creates a tension between policy and practice, where digital assessment initiatives remain largely symbolic rather than transformative. The central research problem, therefore, is to understand how teacher digital literacy affects the implementation and quality of virtual formative assessments in Bahraini high schools. Furthermore, it is important to examine how systemic and institutional factors influence teachers' ability to enact digital policy directives in their daily assessment routines. Investigating this problem will help reveal the barriers and enablers of effective assessment practices and contribute to closing the gap between national reforms and classroom realities.

Research Objectives

1. To examine the impact of teacher digital literacy on the quality of virtual formative assessments in Bahraini high schools.
2. To explore how national education policies influence the implementation of virtual formative assessment practices.
3. To identify the key challenges teachers face in aligning digital assessment tools with effective pedagogical practices.

Research Questions

1. How does the teacher's digital literacy affect the quality of virtual formative assessments in Bahraini high schools?
2. In what ways do national policy frameworks support or hinder virtual formative assessment practices?
3. What are the major barriers faced by teachers in implementing effective digital formative assessments?

Methodology and Procedure

This study is grounded in the positivist research paradigm, which emphasizes objectivity, measurement, and hypothesis testing through empirical observation (Creswell, 2014). Positivism supports the assumption that reality is observable and quantifiable, making it suitable for investigating relationships between variables such as teacher digital literacy and the quality of virtual formative assessment. The paradigm allows the researcher to examine these relationships through statistical techniques, ensuring that results are generalizable across the population of interest (Cohen, Manion, & Morrison, 2018). The decision to adopt the positivist paradigm stems from the study's objective to measure the extent and impact of teacher digital literacy on virtual formative assessment quality in a quantifiable and systematic manner. This paradigm facilitates the use of numerical data to test hypotheses, identify patterns, and generalize findings to a broader population (Neuman, 2014). Furthermore, it is aligned with the nature of the study's variables, both of which can be operationalized through validated instruments and subjected to statistical analysis. Using a quantitative approach allows for greater objectivity, repeatability, and reliability in understanding teacher competencies and assessment practices (Creswell & Plano Clark, 2018).

Research Design and Method

The research adopts a descriptive correlational research design, which is appropriate for determining the degree and nature of relationships between variables without manipulating them (Gay, Mills, & Airasian, 2011). This design is particularly relevant for educational research where ethical or practical constraints prevent experimental manipulation. The quantitative method enables the use of structured surveys and statistical tools to assess digital literacy levels and the implementation quality of virtual formative assessments among teachers. It also supports the examination of correlations and predictive relationships between independent and dependent variables (Fraenkel, Wallen, & Hyun, 2012).

Population and Sampling

The target population for this study comprises all full-time and part-time teachers working in private schools across Bahrain who regularly use digital tools for formative assessment. According to the Ministry of Education and regional academic institutions, there are approximately 2,000 faculty members employed in Bahrain's private high school sector (Higher Education Council, 2022). From this population, a sample of 400 teachers was selected using a stratified random sampling technique. This method ensures that teachers from different schools, disciplines, and departments are proportionally represented, thereby enhancing the generalizability and internal validity of the findings (Bryman, 2016).

The sampling process involved first categorizing schools into strata based on size (small, medium, large) and academic disciplines (STEM, humanities, business, and education). Random samples were then drawn from each stratum using random number generation to ensure unbiased selection. Institutional consent was obtained from participating schools, and invitations were sent to potential respondents via official university email lists. Inclusion criteria included teachers with at least one year of teaching experience and active use of digital assessment tools in virtual or blended learning environments.

Data Collection

Data was collected using a standardized self-administered questionnaire, developed based on two validated instruments: the European DigCompEdu Framework (Redecker, 2017) for measuring teacher digital literacy, and the Formative Assessment Monitoring Tool (FAMT-Q) for assessing the quality of formative assessment practices in virtual settings (Herppich et al., 2018). The questionnaire was composed of three sections: demographic information, digital literacy scale, and formative assessment practice scale. Each item was measured on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), facilitating quantitative analysis. The questionnaire was distributed electronically through institutional email and learning management systems (LMS), with participation being voluntary and anonymous. A pilot study involving 30 teachers was conducted to ensure reliability and clarity of the instrument. Cronbach's alpha for internal consistency was found to be 0.87, indicating high reliability (Field, 2013).

Data Analysis

The data was analyzed using descriptive and inferential statistical techniques. Descriptive statistics, including mean scores, standard deviations, and frequency distributions, were computed to summarize demographic characteristics and overall trends in digital literacy and assessment quality. To examine the relationship between teacher digital literacy and virtual

formative assessment quality, Pearson correlation analysis was conducted. In addition, multiple regression analysis was used to determine the predictive power of various digital literacy components (e.g., digital content creation, assessment literacy, learner empowerment) on assessment quality (Pallant, 2020). All statistical analyses were performed using IBM SPSS Statistics version 26, and significance levels were set at $p < 0.05$. The use of inferential statistics allowed for hypothesis testing and generalization of results to the broader population of secondary/high school teachers in Bahrain.

Ethical Considerations

This study adhered to the highest standards of ethical research. Prior to data collection, ethical approval was sought and obtained from the Institutional Review Board (IRB) of a leading private university in Bahrain. All participants were provided with informed consent forms outlining the study's objectives, procedures, confidentiality measures, and their right to withdraw at any time without penalty (BERA, 2018). Participants were assured that all responses would remain anonymous, and data would be used exclusively for academic purposes. The online survey platform employed encrypted data transmission and restricted access to ensure data security and privacy. No personal identifiers were collected, and aggregated results were used in analysis and reporting. Furthermore, findings will be shared with participating institutions in a manner that promotes professional development without compromising individual privacy.

Data Analysis and Findings

Table 1

Responses regarding Digital Tool Usage

Survey Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	SD
I am confident in using digital tools (e.g., LMS, Google Forms, Kahoot) to conduct formative assessments.	9	25	45	166	155	4.08	0.97
I can create interactive digital quizzes or tasks that assess student understanding effectively.	18	26	40	171	145	4.00	1.06
I use digital data (e.g., quiz scores, analytics) to adjust my teaching strategies in real time.	15	21	39	161	164	4.10	1.02
I am capable of designing formative assessments that align with learning objectives using digital tools.	9	24	38	168	161	4.12	0.96
I integrate multimedia (e.g., videos, simulations) in assessments to enhance student engagement.	13	20	43	155	169	4.12	1.01
I provide students with timely feedback through digital platforms.	12	19	41	164	164	4.12	0.99
I adapt assessment activities based on student performance data from digital platforms.	10	28	42	157	163	4.09	1.01

Survey Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	SD
I feel comfortable experimenting with new digital assessment tools or technologies.	11	22	44	165	158	4.09	0.99
I regularly evaluate the effectiveness of my digital formative assessments.	14	27	46	159	154	4.04	1.03
My digital skills help me to personalize assessments for diverse learner needs.	16	23	41	167	153	4.03	1.02

The survey results shown in Table 1 indicate a high level of confidence and proficiency among respondents in using digital tools for formative assessment, with all mean scores above 4.0. Statements related to integrating multimedia, providing feedback, and designing aligned assessments scored particularly high, reflecting strong digital teaching practices. The relatively low standard deviations suggest consistent responses across participants, indicating widespread competence in digital assessment strategies, as shown in Figure 1 below.

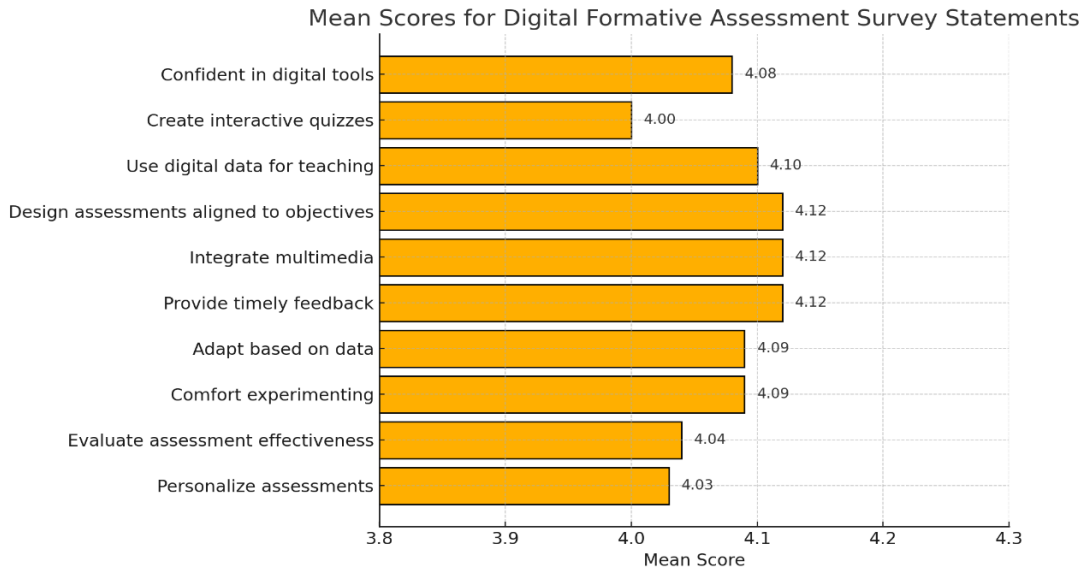

Figure 1: Mean Score of Survey Responses

Table 2
Responses regarding Policy Framework

Survey Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	SD
National education policies clearly define expectations for using digital tools in formative assessment.	7	23	53	138	149	4.08	0.98
I receive adequate guidance from policy documents on how to implement virtual formative assessments effectively.	5	17	64	139	145	4.09	0.93
The resources provided by the Ministry of Education support the integration of digital formative assessment practices.	8	20	48	148	146	4.09	0.96
Policy frameworks encourage innovation and experimentation in digital formative assessment.	4	23	48	128	167	4.16	0.95
Policy mandates sometimes impose unrealistic expectations on teachers regarding digital assessment implementation.	7	19	53	143	148	4.10	0.95
There is sufficient professional development aligned with policy goals to support virtual formative assessment.	11	22	46	132	159	4.07	1.00
School leadership effectively translates national digital assessment policies into actionable classroom practices.	10	21	44	138	157	4.08	0.98
Policy frameworks provide flexibility for teachers to adapt formative assessment to their students' needs using technology.	8	19	42	139	162	4.11	0.95
The focus on standardized testing in policy hinders the effective use of digital formative assessments.	10	24	51	134	151	4.03	0.99
Communication channels between policymakers and teachers regarding digital assessment are sufficient and effective.	12	25	49	135	149	4.01	1.01

Table 2 summarizes survey responses on perceptions of national education policies related to digital formative assessment. Most respondents agree or strongly agree that policies clearly define expectations, provide adequate guidance, and support resources for integrating digital tools, with mean scores around 4.0 or higher. There is a positive view on policy frameworks encouraging innovation and offering flexibility for teachers. However, some concerns exist

about policy mandates imposing unrealistic expectations and the focus on standardized testing potentially hindering effective digital assessment use, as shown in Figure 2 below.

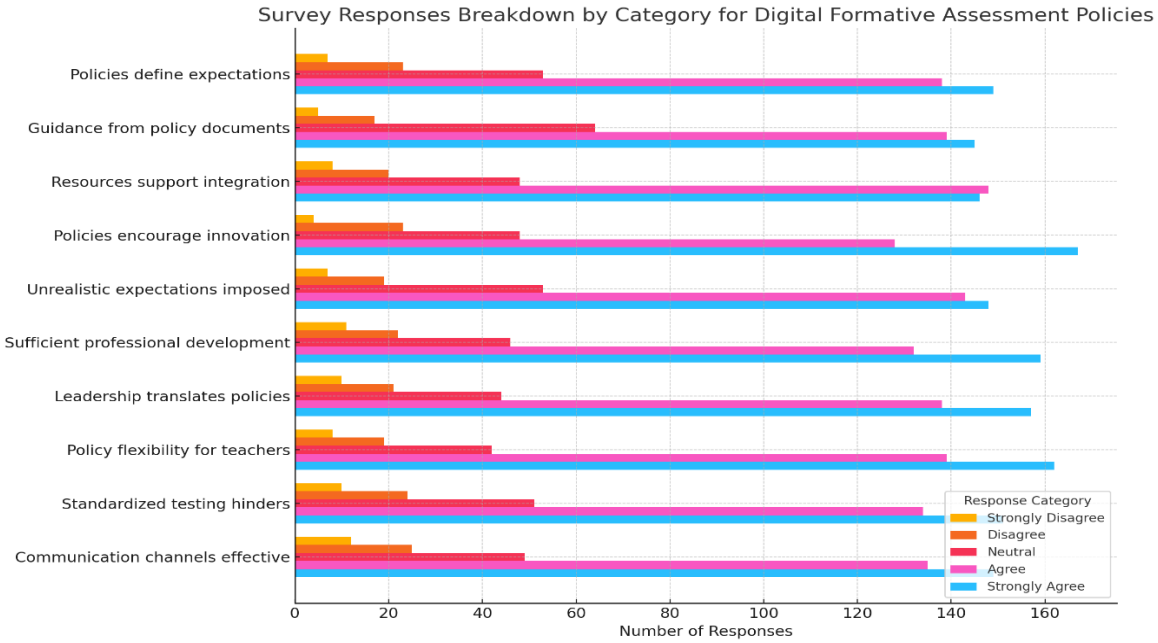

Figure 2: Response rate regarding the policy Framework

Table 3
Responses regarding Barriers

Survey Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	SD
Lack of sufficient training limits my ability to use digital formative assessment tools effectively.	13	24	31	163	139	4.06	1.02
Time constraints make it difficult to design and implement quality virtual formative assessments.	10	25	29	151	155	4.12	1.00
Inadequate technical support hinders the use of digital assessment platforms in my teaching practice.	13	34	35	160	128	3.96	1.06
Limited access to reliable internet or technology resources affects my ability to conduct virtual assessments.	17	28	37	127	161	4.05	1.12
Large class sizes reduce my capacity to provide personalized feedback in digital formative assessments.	9	23	43	135	160	4.12	1.00
A lack of clear guidelines from school leadership impedes consistent use of virtual formative assessments.	15	27	33	144	151	4.00	1.04

Survey Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	SD
Resistance from students to use digital tools negatively affects assessment quality.	18	29	36	137	150	3.95	1.07
Pressure to prepare students for standardized tests limits my use of innovative digital assessments.	12	26	40	142	150	4.01	1.01
Difficulty in integrating formative assessment data with curriculum requirements poses a challenge.	14	30	36	136	154	4.00	1.05
Insufficient collaboration opportunities with colleagues restrict my development of digital assessment skills.	15	25	35	147	148	4.01	1.02

Table 3 highlights key challenges teachers face in implementing digital formative assessments. Major issues include insufficient training, time constraints, limited technical support, and access to reliable technology, all reflected in mean scores around 4.0. Additionally, factors like large class sizes, unclear leadership guidelines, student resistance, and pressure from standardized testing further complicate effective digital assessment use, as shown in Figure 3 below.

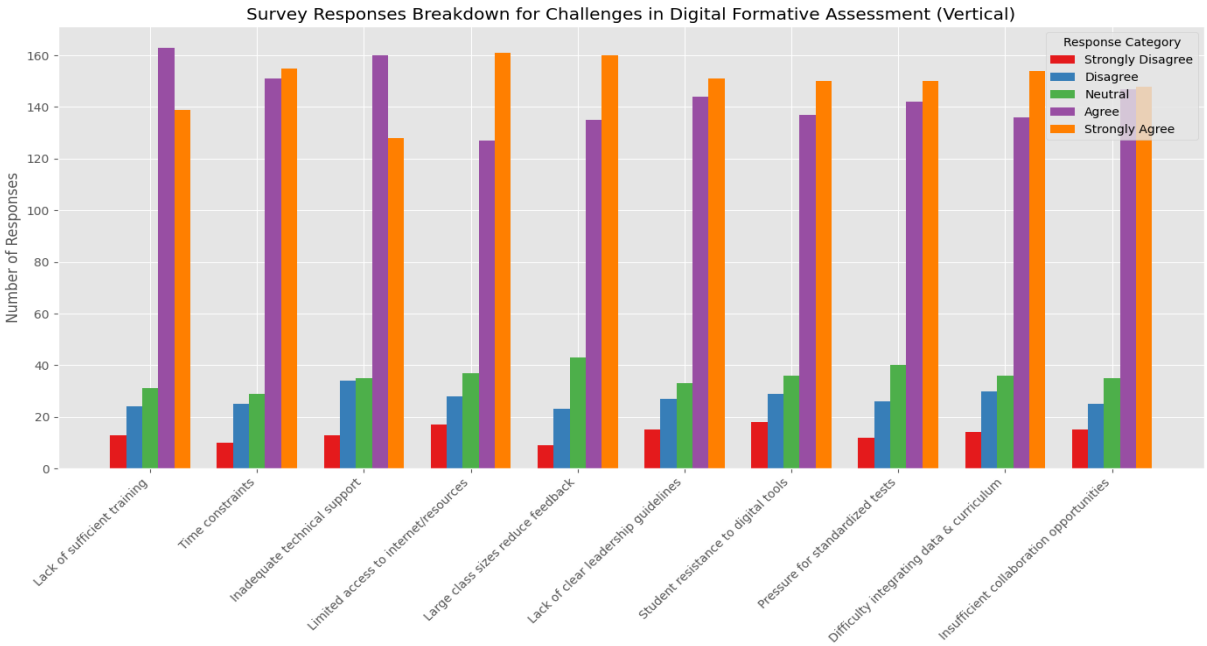

Figure 3: Response rate to Barriers

Table 4
Model Summary for Multiple Regression Predicting Virtual Formative Assessment Quality

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate
1	.918	.843	.839	.145

Note. R = multiple correlation coefficient; R^2 = coefficient of determination; Std. Error = standard error of the estimate.

Table 5
ANOVA for Multiple Regression Model

Source	**SS**	**df**	**MS**	**F**	**p**
Regression	31.89	10	3.19	151.51	< .001
Residual	5.92	389	0.02		
Total	37.81	399			

Note. SS = sum of squares; df = degrees of freedom; MS = mean square; p = significance level.

Table 6
Regression Coefficients Predicting Virtual Formative Assessment Quality

Predictor Group	**B**	**SE B**	**β**	**t**	**p**
Constant	0.32	0.04		8.42	< .001
Confidence with Digital Tools & Content Creation	0.09–0.12	0.01	.13–.16	7.08–8.21	< .001
Assessment Design & Multimedia Integration	0.09–0.10	0.01	.13–.15	7.69–7.80	< .001
Feedback, Adaptation & Skill Development	0.09–0.10	0.01	.12–.14	6.54–7.74	< .001

Note. B = unstandardized coefficient; SE B = standard error of B; β = standardized coefficient; t = t-statistic; p = significance.

The multiple regression analysis in Table 6 indicated a statistically significant model with R^2 = 0.843. While this value suggests that digital literacy variables together explain a large proportion of variance in VFA quality, the relatively weak bivariate correlations (r = .01 to .15) caution against overinterpreting the strength of prediction. The standardized beta coefficients (β = .12–.16) show small effect sizes, meaning that although digital literacy dimensions contribute to VFA outcomes, their practical impact is modest. These findings imply that additional factors, such as institutional leadership, training opportunities, and infrastructure, likely account for much of the variance captured by the model.

Table 7
Pearson Correlation Matrix

Variables	DTC	IQD	DDI	AA	MI	TF
Digital Tool Confidence	1.00	0.05	0.08	0.10	0.07	0.12
Interactive Quiz Design	0.05	1.00	0.03	0.07	0.06	0.04
Data-Driven Instruction	0.08	0.03	1.00	0.09	0.01	0.10
Assessment Alignment	0.10	0.07	0.09	1.00	0.08	0.15
Multimedia Integration	0.07	0.06	0.01	0.08	1.00	0.03
Timely Digital Feedback	0.12	0.04	0.10	0.15	0.03	1.00

Table 7 presents the Pearson correlation coefficients between digital literacy dimensions and VFA quality ranged from 0.01 to 0.15. According to Cohen's (1988) guidelines, these values represent weak correlations, indicating that while there is a statistically significant relationship, the strength of association is minimal. This suggests that other variables, such as institutional leadership, infrastructure, and policy enforcement, may exert stronger influences on VFA quality than individual digital skills.

Discussion

This study sought to examine the relationship between teacher digital literacy and the quality of virtual formative assessments (VFAs) in Bahraini high schools, alongside the influence of national policy frameworks and institutional supports on assessment practices. Contrary to expectations, the correlations between teacher digital literacy and VFA quality were weak. This finding diverges from studies reporting stronger associations in high-resource contexts (Margot & Kettler, 2019; Li et al., 2023) but aligns with research suggesting that digital competence alone is insufficient when broader systemic supports are absent (Xie & Ferguson, 2024; Rehman, 2025). In the Bahraini context, where infrastructure challenges, time constraints, and limited training persist, it is plausible that these contextual barriers dilute the impact of digital literacy on assessment quality. These results align with Pellegrino and Quellmalz's (2010) assertion that technology alone cannot improve assessment outcomes without skilled pedagogical application.

The high mean scores reported by teachers on digital tool confidence and assessment design indicate that many educators in Bahrain have acquired basic operational and pedagogical digital skills. However, qualitative insights and policy-related survey items suggest that these competencies may not yet be fully translated into deep, transformative formative assessment practices. For example, while teachers reported frequent use of quizzes and feedback mechanisms, there is evidence that these practices are often limited in scope, lacking in differentiation and rich feedback loops that characterize high-quality formative assessment (Black & Wiliam, 2009; Herppich et al., 2018). This finding echoes the observations by Zahid and AlManiam (2024) and Razzak (2022), who noted a tendency for virtual assessments in the region to mirror traditional summative tests rather than serve formative functions. The results also underscore a significant policy-practice gap within Bahrain's digital education reform agenda. Teachers generally agreed that national education policies provide clear expectations and resources for digital assessment, yet many expressed concerns about the adequacy of professional development and institutional support to effectively enact these policies. This ambivalence resonates with Escott's (2023) and Mutiah's

(2019) findings in Gulf and Middle Eastern contexts, where top-down mandates are often undermined by insufficient localized support and fragmented training opportunities. The reported pressure from standardized testing and administrative demands further compounds these challenges, constraining teachers' capacity to innovate and personalize digital formative assessments.

Institutional readiness and leadership emerged as critical contextual factors influencing teachers' digital assessment practices. The study's data show that school leadership's role in translating policy into actionable support directly impacts teachers' use of digital formative tools. This finding confirms Darling-Hammond et al.'s (2017) argument that leadership fostering collaborative professional cultures is essential to sustain pedagogical innovation. In the Bahraini context, enhancing leadership capacity to provide ongoing technical support, facilitate professional learning communities, and encourage experimentation is imperative to bridge policy and practice effectively. Overall, the results demonstrate that teacher digital literacy is statistically associated with the quality of virtual formative assessment, but the associations are weak. This indicates that higher levels of competence do not automatically translate into substantially improved assessment practices. Rather, digital skills appear to function as one element within a broader ecosystem of influences, where institutional policies, leadership support, and access to resources play equally critical roles in shaping assessment quality. As Redecker (2017) highlights, digital competence encompasses both technical and pedagogical domains, and teacher preparation programs need to reflect this holistic approach. Secondly, continuous support mechanisms such as mentoring, peer collaboration, and reflective practice opportunities are crucial for translating learned skills into daily classroom realities (Mehanna et al., 2023; Shannaq, 2024). Despite the promising findings, some challenges remain. The study reveals those logistical constraints, such as limited time, large class sizes, and inadequate internet infrastructure, hinder teachers' ability to conduct effective VFAs. These barriers, frequently reported in global research on digital assessment (Zhang et al., 2024; Al Fraidan & Alaliwi, 2024), highlight the necessity of contextualizing policy and professional development within the practical realities of schools. Addressing infrastructure disparities and workload management should be priorities for policymakers seeking to maximize the impact of digital assessment reforms.

Moreover, the study's focus on private secondary/high school teachers as the sampled population presents limitations in fully capturing the experiences of high school teachers, especially those in public schools, where resource constraints may be more pronounced. Future research should seek to include a more representative cross-section of educators across Bahrain's diverse schooling contexts to better understand differential needs and capacities. Qualitative explorations could also enrich understanding of teachers' lived experiences and the nuanced ways they negotiate policy mandates and digital tools used in their formative assessment practices.

Implications

The findings of this study have several important implications for policymakers, educational leaders, and teacher educators in Bahrain and comparable contexts undergoing digital transformation. First, the demonstrated link between teacher digital literacy and the quality of virtual formative assessment underscores the urgency of shifting professional development programs beyond basic ICT skills toward comprehensive digital pedagogical

competence. Training initiatives must be designed to build teachers' capacities in designing adaptive assessments, interpreting digital data, and providing personalized, timely feedback. This requires a systemic approach that integrates digital assessment literacy as a core component of both pre-service and in-service teacher education.

Second, the policy-practice gap identified highlights the necessity for policymakers to engage more closely with frontline educators during policy formulation and implementation. Creating mechanisms for two-way communication and feedback can help ensure that digital assessment policies are contextually relevant, flexible, and responsive to classroom realities. Furthermore, providing schools with greater autonomy to adapt digital assessment tools and strategies according to learner needs could enhance the meaningful integration of technology in formative assessment. Third, school leadership plays a pivotal role in fostering a culture conducive to digital innovation and formative assessment of excellence. Leaders should be supported to cultivate professional learning communities, allocate collaborative planning time, and champion continuous experimentation and reflective practice. Institutional investments in reliable infrastructure, ongoing technical support, and workload management are equally critical to remove logistical barriers that constrain teachers' digital formative assessment practices.

This study suggests that achieving high-quality virtual formative assessment is not solely dependent on technological availability but is fundamentally rooted in human and organizational factors. Therefore, educational reforms aiming at digital transformation should adopt a holistic approach that balances infrastructure investments with targeted teacher capacity-building and supportive school environments. This integrated strategy is essential to harness the full potential of digital formative assessment for improving student learning outcomes.

Conclusion

This study concludes that while teacher digital literacy has a statistically significant relationship with VFA quality, the effect is weak in practical terms. The evidence suggests that the successful implementation of digital formative assessment requires more than individual competence. Structural support, such as stable policies, professional development, leadership encouragement, and adequate infrastructure, are equally critical. Policymakers and school leaders should therefore adopt a holistic approach that combines capacity building with systemic reforms, ensuring that digital assessment policies are both feasible and impactful in Bahraini high schools.

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