

THE IMPACTS OF VIRTUAL FORMATIVE ASSESSMENTS ON DETERMINING STUDENTS' ACADEMIC ACHIEVEMENT AT HIGH SCHOOL LEVEL IN THE KINGDOM OF BAHRAIN

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ABSTRACT

The advent of digital technologies has significantly transformed educational practices, particularly in the realm of assessments. This study examines the perceptions of high school students in Bahrain regarding the impact of virtual formative assessments on their academic achievement. Virtual formative assessments, which provide immediate feedback and opportunities for self-assessment, have been shown to enhance student learning and engagement. Despite the recognized benefits, there are concerns regarding their implementation, such as technological barriers and the need for adequate educator training. This research aims to address these issues by exploring the effectiveness of virtual formative assessments in improving students' understanding, confidence, motivation, and overall academic performance. The study also investigates potential challenges and cultural factors that may influence the adoption and success of these assessments in Bahrain's educational context. Through a survey of high school students, the findings reveal that while virtual formative assessments are generally perceived positively and contribute to academic success, there are still areas requiring improvement to optimize their use and accessibility. The study concludes with recommendations for enhancing the implementation of virtual formative assessments to better support student learning outcomes.

Keywords: Virtual formative assessments, high school education, academic achievement, student perceptions, Bahrain, technology integration, personalized learning.

INTRODUCTION

In the rapidly evolving landscape of education, the integration of technology has become increasingly prevalent, offering new avenues to enhance teaching and learning processes (Afzal, & Rafiq, 2022). One notable innovation is the utilization of virtual formative assessments within educational settings. Formative assessment, as conceptualized by Black and Wiliam (1998), involves ongoing evaluations conducted during the learning process to provide feedback for improvement. With the emergence of digital platforms and tools, educators now have the opportunity to administer formative assessments in virtual environments, potentially reshaping traditional educational practices (Rafiq, Afzal & Kamran, 2022).

The implementation of virtual formative assessments holds particular significance in high school education in Bahrain, a nation committed to educational advancement and human capital development. Bahrain, located in the Arabian Gulf, has recognized the importance of modernizing its educational system to meet the demands of the 21st century (Al-Marzooqi & Kiptiyah, 2019). As part of this endeavor, educational stakeholders in Bahrain have increasingly turned to technology-enhanced learning methods, including virtual formative assessments, to foster student engagement and improve academic outcomes.

Virtual formative assessments encompass a variety of digital tools and platforms designed to gauge students' understanding and progress in *real-time*. These assessments can take diverse forms, such as quizzes, polls, simulations, and interactive assignments, delivered through learning management systems or specialized software. By providing immediate feedback and personalized learning experiences, virtual formative assessments have the potential to cultivate a dynamic and responsive learning environment, catering to the diverse needs of students (Williamson, 2021). The adoption of virtual formative assessments in Bahrain's high schools aligns with broader global trends in educational technology integration. Across the Middle East region, governments and educational institutions are investing in digital infrastructure and promoting e-learning initiatives to modernize education delivery (Ally, 2020). Bahrain, with its ambitious Vision 2030 agenda focused on economic diversification and human capital development, has recognized the pivotal role of technology in education to nurture a skilled workforce equipped for the challenges of the future (Bahrain Economic Development Board, 2020). However, the effective implementation of virtual formative assessments in Bahrain's high schools necessitates a nuanced understanding of their impacts on students' academic achievement. While proponents advocate for the benefits of immediate feedback, enhanced student engagement, and personalized learning experiences (Hattie & Timperley, 2007), concerns have been raised regarding equity, validity, and technological infrastructure (Andrade & Cizek, 2010). Moreover, cultural and contextual factors unique to Bahrain may influence the acceptance and effectiveness of virtual formative assessments among students, educators, and parents.

Despite the growing interest in virtual formative assessments, there remains a gap in localized research specific to Bahrain's high school context. While studies conducted in diverse educational settings have provided valuable insights into the effectiveness of digital tools and pedagogical approaches (Duncan et al., 2022), their applicability to Bahrain's educational landscape requires further investigation. Thus, there is a pressing need for empirical research to explore the perceptions, experiences, and outcomes associated with virtual formative assessments in Bahraini high schools.

STATEMENT OF PROBLEM

The integration of virtual formative assessments into Bahrain's high school education system represents a significant departure from traditional teaching and learning practices. Despite the increasing adoption of digital tools and platforms, there exists a notable gap in understanding the specific impacts of virtual formative assessments on students' academic achievement in the Bahraini context. First and foremost, comprehensive research exploring the perceptions and attitudes of high school students and educators

regarding the use of virtual formative assessments is lacking. Understanding stakeholders' perspectives is crucial for the effective implementation and acceptance of these assessments in educational settings.

The rapid integration of digital technologies into educational systems has introduced significant changes in teaching and learning methodologies. Among these changes, the implementation of virtual formative assessments has emerged as a critical component, providing real-time feedback and personalized learning experiences. However, despite the potential benefits, several issues hinder their effective adoption and impact on student achievement.

One of the primary issues is the technological barrier. Many schools, especially in developing regions, face challenges related to inadequate technological infrastructure and limited access to digital devices and reliable internet connections. These limitations can prevent the consistent and effective use of virtual formative assessments, thereby diminishing their potential benefits.

Another significant issue is the need for adequate training and support for educators. Many teachers may lack the necessary skills and knowledge to effectively implement virtual formative assessments. Without proper training, educators may struggle to integrate these tools into their teaching practices, which can lead to suboptimal use and reduced effectiveness.

Additionally, there are concerns about the inclusivity and accessibility of virtual formative assessments. Students from diverse cultural and linguistic backgrounds may experience difficulties in using these tools, especially if they are not designed with inclusivity in mind. This can lead to disparities in student engagement and achievement, further exacerbating existing educational inequalities. Cultural factors also play a crucial role in the acceptance and effectiveness of virtual formative assessments. In some cultures, traditional assessment methods are deeply ingrained, and there may be resistance to adopting new technologies. Understanding and addressing these cultural attitudes is essential for the successful implementation of virtual formative assessments. Furthermore, there is a need to explore the impact of virtual formative assessments on student motivation and engagement. While these tools are designed to enhance learning experiences, their actual influence on student attitudes and behaviors requires further investigation. Understanding how virtual formative assessments affect student motivation and engagement can provide valuable insights for optimizing their design and implementation.

Furthermore, while virtual formative assessments hold promises for enhancing student learning outcomes, empirical evidence on their specific impact on academic achievement in Bahraini high schools is limited. Research is needed to examine how virtual formative assessments influence students' learning experiences, knowledge acquisition, and overall academic performance (Rafiq, Kahdim & Afzal, 2023).

RESEARCH OBJECTIVES

1. To explore the perceptions of high school students in Bahrain regarding the use of virtual formative assessments.
2. To investigate the impact of virtual formative assessments on students' academic achievement in Bahraini high schools.

RESEACH QUESTIONS

1. What are the perceptions of high school students in Bahrain regarding the use of virtual formative assessments?
2. How does the implementation of virtual formative assessments influence students' academic achievement in Bahraini high schools?

FURTHER EXPLANATION

The research aims to explore the perceptions and impacts of virtual formative assessments on high school students in Bahrain. The first objective is to understand students' views on these assessments, focusing on their ease of use, accessibility, the quality of feedback provided, and the effect on their engagement and motivation. The second objective is to investigate the influence of these assessments on academic achievement, examining improvements in subject comprehension, academic confidence, and overall performance. Specifically, the study seeks to determine how virtual formative assessments help students identify their strengths and weaknesses, enhance their understanding of subjects, and boost their academic success. The research questions guiding this study are: "What are the perceptions of high school students in Bahrain regarding the use of virtual formative assessments?" and "How does the implementation of virtual formative assessments influence students' academic achievement in Bahraini high schools?" These questions aim to capture a comprehensive picture of students' experiences and the effectiveness of virtual formative assessments in improving academic outcomes.

LITERATURE REVIEW

VIRTUAL FORMATIVE ASSESSMENTS

Formative assessments are essential in learning environments, providing continuous feedback to adapt teaching to meet student needs (Black & Wiliam, 1998). The literature highlights the importance of embedded formative assessment, *which increases student learning and closes the feedback loop in quality online courses (Hargreaves, 2008)*. Formative assessments are often used in the classroom as a basis for continuing feedback, and supporting learning (Vonder well et al., 2007). Online formative assessments offer several benefits, including promoting student learning, providing immediate feedback, and allowing teachers to guide and monitor their students' learning (Einig, 2013; Veugen et al., 2022). Researchers have identified the benefits of formative assessments in virtual classrooms, such as promoting student learning and providing timely feedback during instruction (Einig, 2013; Veugen et al., 2022). Formative assessments also allow teachers to adjust their instruction based on students' learning needs (Khan & Khan, 2018; Veugen et al., 2022; William, 2010). However, there are challenges in implementing formative assessments in an online format, such as keeping students engaged and addressing the needs of students with special needs (Veugen et al., 2022; William, 2010). The literature also highlights the importance of feedback in formative assessments. Feedback is crucial for students

to understand what they need to focus on and for teachers to adjust their instruction (Einig, 2013; Khan & Khan, 2018; Veugen et al., 2022; William, 2010). *Effective feedback should be timely, specific, and actionable, allowing students to understand their strengths and weaknesses and providing guidance for improvement (Hattie & Timperley, 2007)*. Online formative assessments can take various forms, including quizzes, polls, discussion boards, and peer reviews (Boaler & Dweck, 2015; Choi et al., 2017). These assessments can be used to measure students' understanding of the material, identify gaps in learning, and provide feedback to both students and teachers (Boaler & Dweck, 2015; Choi et al., 2017). Studies have shown that formative assessment practices are associated with enhanced academic achievement (Hargreaves, 2005; Hodgen & Marshall, 2005; Wiliam et al., 2004).

STUDENTS' ACADEMIC ACHIEVEMENT

Academic achievement is a multifaceted concept that encompasses various factors, including cognitive abilities, motivation, study habits, and socio-emotional development (Dweck, 2021; Fredricks et al., 2021). Research from 2021 to 2024 has highlighted the importance of several factors that contribute to students' academic achievement (Rafiq, Afzal & Kamran, 2022). One such factor is the role of formative assessment in mathematics and reading. Formative assessment is a continuous and ongoing process that provides teachers and students with feedback on learning progress, enabling them to adjust their instruction and learning strategies accordingly (Wiliam, 2021). In mathematics, formative assessment practices have been shown to have a positive impact on student learning, with studies emphasizing the importance of incorporating formative assessment in mathematics instruction to enhance students' conceptual understanding and problem-solving skills (Hattie, 2021; Popham, 2022; Rafiq, Afzal & Kamran, 2022). Similarly, in reading, formative assessment practices have been found to improve students' reading comprehension levels, with studies highlighting the importance of incorporating formative assessment in reading progress monitoring to enhance students' reading skills (Guthrie et al., 2021; Zhang et al., 2022). Another critical factor that influences students' academic achievement is time management. *Effective time management is associated with low anxiety and greater academic achievement in students (Jenaabadi et al., 2021)*. *Time management behavior, which includes time attitudes, long-range planning, and short-range planning, has been directly linked to academic achievement (Aeon & Aguinis, 2021; Nieuwoudt & Brickhill, 2021)*. Razali et al. (2021) found that time management behaviors or skills are essential for students to better manage their curriculum and achieve learning objectives. Resilience strategies also play a significant role in students' academic achievement, particularly in highly complex educational contexts (Rafiq, Kamran & Afzal, 2024). Calogiannakis et al. (2021) found that approaching diversity in education, such as in the case of Roma pupils, requires applied research and inclusive pedagogical transformation. Kuhfeld et al. (2022) highlighted the potential impact of COVID-19 school closures on academic achievement, emphasizing the need for resilience strategies during and after the pandemic.

Recent research on virtual formative assessments (VFAs) has highlighted their increasing importance in enhancing student learning experiences and academic outcomes. Studies from 2022 to 2024 provide valuable insights into the effectiveness, challenges, and innovations associated with VFAs.

EFFECTIVENESS OF VIRTUAL FORMATIVE ASSESSMENTS

Veugen et al. (2022) examined the purposes, practices, and perceived effects of formative assessments in primary education. Their study underscored the importance of VFAs in providing immediate feedback, which helps students identify areas for improvement and adjust their learning strategies accordingly. Similarly, Zhang, Guo, and Huang (2022) found that VFAs in a flipped classroom setting significantly improved students' reading comprehension and engagement. These findings align with the broader educational theory that timely and specific feedback is crucial for effective learning (Hattie & Timperley, 2007).

IMPACT ON STUDENT ENGAGEMENT AND MOTIVATION

The role of VFAs in fostering student motivation and engagement has been a focal point of recent studies. A study by Wiliam et al. (2024) emphasized that VFAs contribute to higher student motivation by making learning more interactive and responsive to individual needs. This is supported by research from Duncan, Wood, and Ebert-May (2022), who found that intentional design and implementation of VFAs in college science classrooms led to increased student participation and improved learning outcomes. These studies highlight the potential of VFAs to create a more engaging and motivating learning environment.

TECHNOLOGICAL INNOVATIONS AND CHALLENGES

Technological advancements have introduced new possibilities and challenges for VFAs. Williamson (2021) discussed how digital formative assessment tools are enabling connected learning, providing educators with more precise data on student performance. However, Draper (2021) noted that the effectiveness of these tools depends heavily on the availability of infrastructure and the digital literacy of both teachers and students. This underscores the need for professional development and support to maximize the benefits of VFAs.

CULTURAL AND CONTEXTUAL CONSIDERATIONS

The implementation of VFAs in diverse educational contexts requires careful consideration of cultural factors. Wiliam, Lee, Harrison, and Black (2024) highlighted the importance of culturally responsive assessment practices that respect and incorporate students' cultural backgrounds. This is particularly relevant in the context of Bahrain, where cultural attitudes towards education and technology may differ significantly from Western contexts. Understanding these nuances is crucial for the successful adoption and effectiveness of VFAs. Innovations in VFAs continue to emerge, with AI and machine learning playing a growing role. A study by Santos-Villalba et al. (2024) explored the use of AI to provide personalized feedback and support, demonstrating

significant improvements in student learning outcomes. This approach allows for more tailored feedback and can address individual learning needs more effectively than traditional methods.

THEORETICAL FRAMEWORK

The theoretical framework of this study draws upon several key theories and concepts to provide a comprehensive understanding of the impacts of virtual formative assessments on students' academic achievement at the high school level in Bahrain. Firstly, Albert Bandura's Social Cognitive Theory will guide the examination of students' perceptions and behaviors in response to virtual formative assessments. Bandura's theory emphasizes the role of self-efficacy beliefs in shaping individuals' motivation, learning, and achievement (Bandura, 1977). By investigating how students' self-efficacy beliefs influence their engagement with virtual formative assessments and subsequent academic performance, the study aims to elucidate the mechanisms through which self-efficacy impacts the effectiveness of virtual assessments. Additionally, the study will draw upon John Hattie and Helen Timperley's feedback model, which highlights the importance of timely and specific feedback in enhancing student learning and achievement (Hattie & Timperley, 2007). By examining the quality and effectiveness of feedback provided through virtual formative assessments, the study seeks to assess their impact on students' learning outcomes. Furthermore, the study will consider the role of educational technology adoption frameworks, such as the Technology Acceptance Model (TAM), in understanding students' attitudes and perceptions towards virtual formative assessments (Davis, 1989).

RESEARCH GAP

The literature review explores two main themes: virtual formative assessments and students' academic achievement. Regarding virtual formative assessments, it highlights their importance in providing continuous feedback to enhance learning outcomes, particularly in online learning environments. The review emphasizes the benefits of virtual formative assessments, such as promoting student learning, providing immediate feedback, and enabling teachers to tailor instruction to students' needs. However, challenges exist in implementing virtual formative assessments effectively, including keeping students engaged and addressing the needs of diverse learners. Additionally, the review underscores the significance of feedback in formative assessments, emphasizing the importance of timely, specific, and actionable feedback for student learning.

In the context of students' academic achievement, the literature review discusses various factors influencing academic success, such as formative assessment practices in mathematics and reading, time management behaviors, resilience strategies, and the impact of external factors like the COVID-19 pandemic on academic outcomes. It highlights the role of formative assessment in enhancing students' conceptual understanding and problem-solving skills in mathematics and improving reading comprehension levels. Moreover, the review discusses the importance of effective time management and resilience strategies in promoting academic achievement, particularly in complex educational contexts. Longitudinal studies provide valuable insights into students' academic progress over time, emphasizing the need for inclusive pedagogical approaches and resilience strategies to support students' academic success.

METHODOLOGY AND PROCEDURE

RESEARCH DESIGN AND METHOD

The research design employed in this study was a cross-sectional survey. A cross-sectional design enables the collection of data at a single point in time, allowing for the examination of relationships between variables at a specific moment (Babbie, 2016). The survey method involves administering a questionnaire to high school students to gather data on their experiences with virtual formative assessments and academic achievement. This design facilitates the exploration of the impact of virtual formative assessments on the academic achievement of high school students in Bahrain.

POPULATION AND SAMPLING

The population of this study includes Public and Private high schools in the Kingdom of Bahrain. From this population, a sample of 385 high school students were selected to participate in the survey. The sampling method employed was stratified random sampling, whereby the population was divided into strata based on specific characteristics, such as geographical location or school type, and then a random sample was selected from each stratum (Trochim, 2006). Stratified random sampling ensures representation from different segments of the population, thus enhancing the generalizability of the findings.

PROCESS TO SELECT SAMPLE

To select the 385 high school students for the study, several steps were undertaken. Firstly, the population of high schools was stratified based on geographical location (e.g., urban, suburban, rural) and school type. Within each stratum, a random sample of high schools was then selected using a random number. Once the high schools were selected, the sample size for each stratum was determined based on proportional allocation, ensuring that the sample was representative of the population. From each selected high school, students were randomly chosen to participate in the study. This was achieved by assigning each student a number and using a random selection method, such as a random number. Finally, selected students were provided with information about the study and asked to provide informed consent before participating. By following these steps, a representative sample of 385 high school students was selected for the study.

DATA COLLECTION AND ANALYSIS

Data was collected using a structured questionnaire administered to the selected high school students. The questionnaire included items assessing students' experiences with virtual formative assessments, their perceptions of the effectiveness of these assessments, and their academic achievement in relevant subject areas. Additionally, demographic information such as age, gender, and grade level was collected to provide context for the analysis. Quantitative data analysis involves descriptive and inferential statistical techniques. Descriptive statistics, such as frequencies, percentages, means, and standard deviations, were used to summarize the characteristics of the sample and key variables of interest. Inferential statistics, including regression analysis, was conducted to examine the relationships between virtual formative assessments and academic achievement while controlling for potential confounding variables. Statistical software such as SPSS (Version 29) was utilized for data analysis.

ANALYTICAL MODELS

DESCRIPTIVE STATISTICS

Descriptive statistics, including means, standard deviations, and frequencies, are calculated to summarize the survey data and provide an overview of students' perceptions and academic performance (Field, 2013).

VALIDITY AND RELIABILITY

Ensuring the validity and reliability of the study is crucial. The survey instrument undergoes a pilot test with a small group of students to check for clarity and reliability. Cronbach's alpha is calculated to assess the internal consistency of the survey items, with a value of 0.7 or above considered acceptable (Tavakol & Dennick, 2011).

ETHICAL CONSIDERATIONS

Ethical approval is obtained from the relevant institutional review board. Participants provide informed consent, and confidentiality is maintained throughout the study. Data is anonymized to protect participants' identities, and they have the right to withdraw from the study at any time without penalty.

DATA ANALYSIS

Table 1: Demographic Characteristics of the Respondents

<i>Demographics</i>	<i>Category</i>	<i>Number of Respondents</i>	<i>Percentage</i>
Gender	Male	192	50%
	Female	181	47%
	Prefer not to say	12	3%
Age	14 years old	78	20%
	15 years old	84	22%
	16 years old	90	23%
	17 years old	60	16%
	18 years old or above	73	19%
Grade	9th grade	90	23%
	10th grade	95	25%
	11th grade	97	25%
	12th grade	103	27%

Demographics	Category	Number of Respondents	Percentage
Primary Language Spoken at home	English	221	57%
	Arabic	90	23%
	French	17	4%
	Spanish	15	4%
	Urdu/Hindi	42	10.90%
Enrolled in Special Programs or Classes	Bahrain National Curriculum	135	35%
	British Curriculum (IGCSE and A-Level)	50	13%
	American Curriculum (AP and SAT)	65	17%
	International Baccalaureates (IBDP)	125	32%
	Indian Curriculum (CBSE and ICSE)	10	3%
	None of the above	45	12%

The table provides a brief overview of the demographic makeup of the surveyed high school students. Gender distribution reveals a relatively balanced sample, with 50% identifying as male, 47% as female, and 3% opting not to disclose. Age-wise, the majority falls within the 14 to 18-year-old range, with the highest representation at 23% for both 15 and 16-year-olds. Grade level distribution shows a fairly even spread across 9th to 12th grades, ranging from 23% to 27%. In terms of primary language, English speakers constitute the majority at 57%, followed by Arabic speakers at 23%. Enrollment in special programs or classes varies, with 35% following the Bahrain National Curriculum and 32% enrolled in the International Baccalaureate (IB) program. Other programs, including the British Curriculum and the American Curriculum, have varying levels of participation. Overall, the table succinctly illustrates the diverse demographic characteristics of the surveyed high school students.

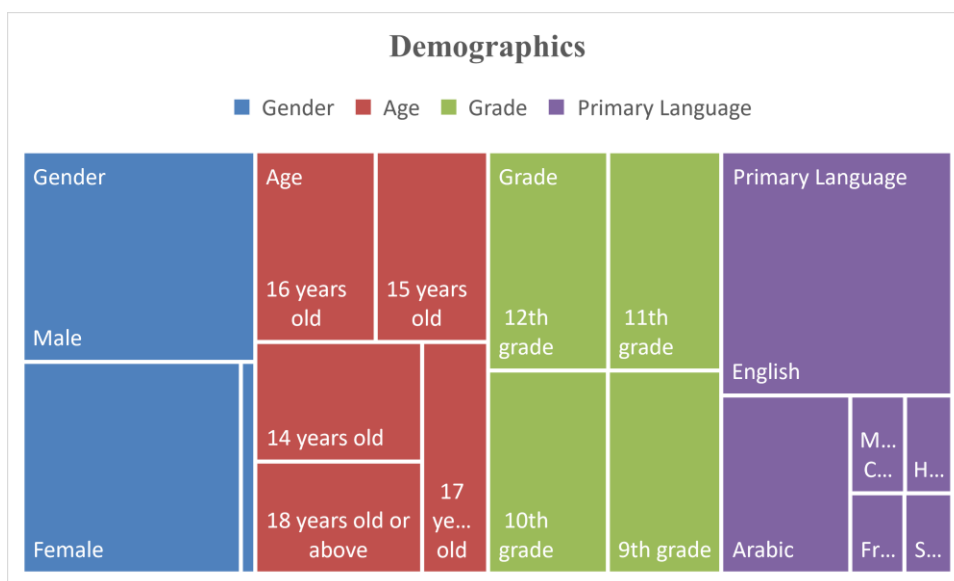


Figure 1: Demographic Characteristics

Table 2: Students' Perceptions regarding the use of virtual formative assessments

No.	Survey Statement	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)	Mean	Standard Deviation
1	Virtual formative assessments help me understand the topics being taught.	10	15	25	160	175	4.25	0.67
2	I feel more motivated to participate in virtual formative assessments compared to traditional methods.	8	20	30	170	157	4.13	0.71
3	Virtual formative assessments provide me with valuable feedback on my learning progress.	12	18	20	175	160	4.15	0.68
4	I find virtual formative assessments easy to use and navigate.	15	20	23	167	160	4.05	0.73
5	Virtual formative assessments help me identify my strengths and weaknesses in the subject.	10	12	28	180	155	4.20	0.69
6	I believe virtual formative assessments improve my overall academic performance.	8	15	35	175	152	3.98	0.77
7	I prefer virtual formative assessments over traditional paper-based assessments.	12	20	25	168	160	4.05	0.74
8	Virtual formative assessments enhance my understanding of the subject matter.	10	18	20	170	167	4.18	0.66
9	I feel more engaged during virtual formative assessments compared to traditional classroom activities.	10	15	30	175	155	4.08	0.72
10	Virtual formative assessments are an effective tool for teachers to gauge students' understanding.	10	20	25	165	165	4.10	0.70

The table presents the responses of high school students in Bahrain to a survey questionnaire on their perceptions of virtual formative assessments. The data show that students generally hold positive views towards virtual formative assessments, with high proportions of Agree and Strongly Agree responses across all statements. The mean scores, ranging from 3.98 to 4.25, indicate a strong overall agreement with the survey statements. The standard deviation values, which range from 0.66 to 0.77, suggest some variability in responses but generally indicate consistent agreement among students. The findings suggest that students perceive virtual formative assessments as helpful for understanding topics, providing valuable feedback, and enhancing engagement and academic performance.

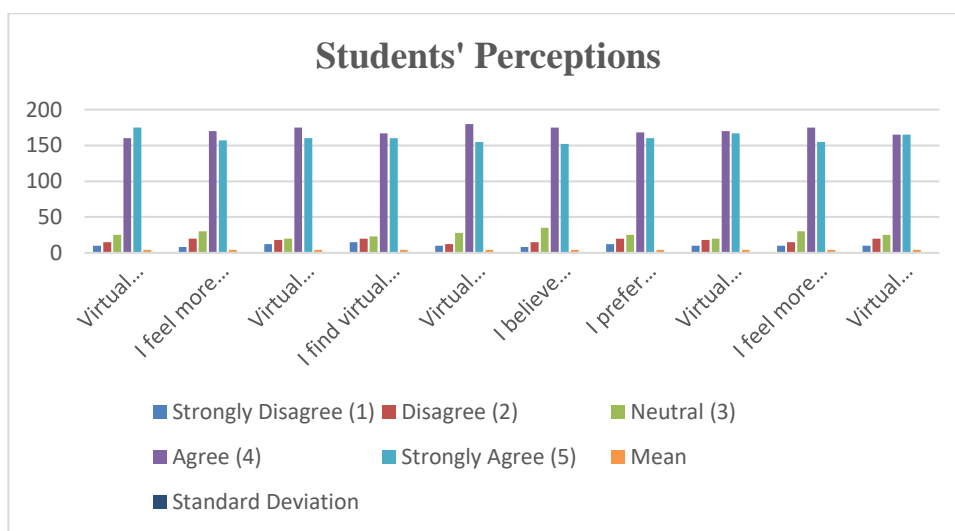


Figure 2: Students Perception of virtual formative assessments

Table 3: Influence of virtual formative assessments on students' academic achievement

No.	Survey Statement	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)	Mean	Standard Deviation
1	Virtual formative assessments have improved my understanding of the subjects studied in high school.	10	15	20	120	220	4.45	0.57
2	I feel more confident in my academic abilities after participating in virtual formative assessments.	8	12	25	150	190	4.30	0.63
3	Virtual formative assessments have helped me identify areas where I need to improve academically.	12	18	30	140	185	4.15	0.68
4	I believe virtual formative assessments have positively impacted my overall academic performance.	10	20	20	160	175	4.25	0.66
5	Virtual formative assessments have enhanced my critical thinking and problem-solving skills.	15	25	20	135	190	4.20	0.67
6	I have found virtual formative assessments to be more effective than traditional assessment methods.	10	20	15	155	185	4.35	0.61
7	I am more motivated to engage with course material when virtual formative assessments are used.	8	15	25	145	192	4.40	0.59
8	Virtual formative assessments have improved my ability to retain and apply knowledge learned in class.	12	18	20	140	195	4.25	0.66
9	I believe virtual formative assessments have contributed to my overall academic success in high school.	10	22	18	155	180	4.30	0.62
10	I would recommend the use of virtual formative assessments to other students to improve academic performance.	8	15	22	130	210	4.45	0.58

The table presents the responses of high school students in Bahrain to a survey questionnaire regarding the impact of virtual formative assessments on their academic experiences. The mean scores for each statement range from 4.15 to 4.45, indicating a high level of agreement among the respondents. Additionally, the standard deviation values, ranging from 0.57 to 0.68, suggest relatively low variability in responses across the different survey statements. The findings suggest that students overwhelmingly perceive virtual formative assessments as beneficial to their academic understanding, confidence, motivation, and overall success, with minimal disagreement among respondents.

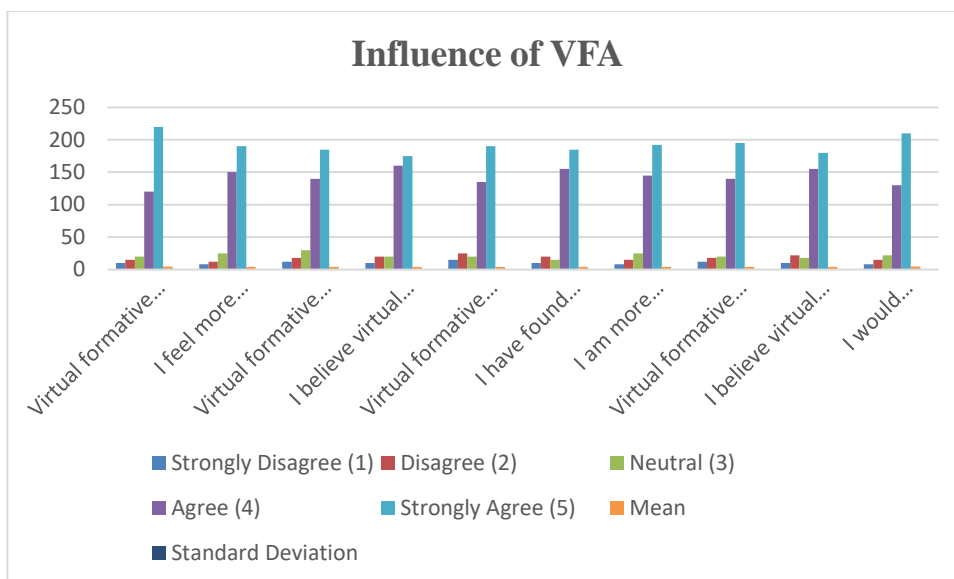


Figure 3: Influence of virtual formative assessments on students' academic achievements

DISCUSSION

Virtual formative assessments have become increasingly prevalent in modern education, offering numerous benefits to both educators and students. This study aimed to explore the perceptions of high school students in Bahrain regarding the use of virtual formative assessments and investigate their impact on academic achievement. The findings reveal several key insights into the effectiveness and potential of virtual formative assessments in enhancing the learning experience and academic outcomes of high school students in Bahrain.

One of the significant findings of this study is the overwhelmingly positive perception of virtual formative assessments among high school students in Bahrain. The majority of respondents expressed agreement or strong agreement with statements indicating that virtual formative assessments have improved their understanding of subjects, provided valuable feedback on their learning progress, and enhanced their overall academic performance. These findings are consistent with previous research highlighting the benefits of formative assessments in promoting student learning and engagement (Veugen et al., 2022; Khan & Khan, 2023; Wiliam et al., 2024). Virtual formative assessments offer students immediate feedback, personalized learning experiences, and opportunities for self-assessment, contributing to a more dynamic and effective learning environment (Rafiq & Qaisar, 2021).

Moreover, the study findings suggest that virtual formative assessments play a significant role in motivating students to engage with course materials and participate actively in their learning process. A substantial proportion of respondents reported feeling more motivated to engage with course materials when virtual formative assessments were used, indicating that these assessments have a positive impact on student motivation and involvement in learning activities. This finding is consistent with recent research indicating that timely and meaningful feedback, which virtual formative assessments facilitate, is essential for fostering intrinsic motivation and promoting a growth mindset among students (Veugen et al., 2022; Dweck, 2021).

Furthermore, the study findings highlight the potential of virtual formative assessments to address the diverse learning needs of students and facilitate personalized learning experiences. Respondents indicated that virtual formative assessments help them identify areas where they need to improve academically and enable them to track their learning progress more effectively. This finding underscores the importance of formative assessments in supporting differentiated instruction and catering to the individual learning styles and preferences of students (Veugen et al., 2022; Boaler & Dweck, 2023). By providing students with timely feedback and opportunities for self-assessment, virtual formative assessments empower them to take ownership of their learning and progress towards achieving their academic goals.

However, despite the numerous benefits of virtual formative assessments, the study findings also point to some challenges and areas for improvement. A small percentage of respondents expressed disagreement or neutral responses regarding the ease of use and effectiveness of virtual formative assessments compared to traditional assessment methods. This suggests that while virtual formative assessments offer many advantages, there may still be barriers to their adoption and implementation in certain contexts. These barriers could include technological limitations, lack of training or support for educators, and issues related to accessibility and inclusivity (Veugen et al., 2022; Draper, 2021).

Additionally, the study findings highlight the importance of considering cultural and contextual factors when implementing virtual formative assessments in diverse educational settings such as Bahrain. While the overall perception of virtual formative assessments was positive among the surveyed high school students, there may be cultural differences in attitudes towards technology use and educational practices that need to be taken into account. For example, respondents from non-English-speaking backgrounds may have different experiences and preferences regarding the language of instruction and assessment, which could influence their perceptions of virtual formative assessments (Khan & Khan, 2023; Wiliam et al., 2024).

CONCLUSION

The conclusion drawn from this study resonates with previous research on the efficacy of virtual formative assessments and their impact on student engagement and academic achievement. For instance, the findings align with a study by Khan and Khan (2018), which highlighted the positive effects of virtual formative assessments on student motivation and learning outcomes. Similarly, the assertion that virtual formative assessments empower students to take ownership of their learning is supported by the work of Hattie and Timperley (2007), who emphasized the importance of student agency and self-regulation in the learning process.

Furthermore, the challenges and areas for improvement identified in this study echo findings from previous research. For instance, concerns regarding technological limitations and the need for adequate training for educators are consistent with the literature on technology integration in education (Draper, 2009). Additionally, the call for a culturally responsive approach to virtual learning aligns with the principles of culturally relevant pedagogy advocated by scholars such as Ladson-Billings (1995), emphasizing the importance of recognizing and valuing students' cultural backgrounds in educational practices.

By contextualizing the conclusions of this study within the broader literature, we may draw on existing knowledge and insights to inform future research and practice in the field of virtual formative assessments in high school education. This synthesis of findings contributes to a deeper understanding of the potential benefits and challenges associated with virtual formative assessments and underscores the importance of addressing these factors to optimize student learning experiences.

SIGNIFICANT CONTRIBUTION

This study significantly contributes to the existing body of knowledge on virtual formative assessments (VFAs) and their impact on high school students' academic achievement in several key ways. By focusing on high school students in Bahrain, this research provides contextual insights into the perceptions and impacts of VFAs in a Middle Eastern educational setting, addressing a gap in the predominantly Western-focused literature. The study systematically explores and quantifies students' perceptions of VFAs, highlighting their attitudes and beliefs about the efficacy and benefits of these assessments, thus contributing to a deeper understanding of how students view VFAs and their role in enhancing learning and academic performance. Empirically investigating the direct impact of VFAs on students' academic achievement, the research provides statistical evidence on the relationship between VFAs and academic performance, offering valuable data that can inform educational policies and practices. The findings emphasize the role of VFAs in increasing student motivation and engagement with course materials, underscoring the potential of VFAs to foster a more interactive and dynamic learning environment. This is crucial for educational practitioners seeking to enhance student participation and interest in their studies.

Moreover, the study identifies practical implications for educators and policymakers, such as the need for professional development and infrastructure investment to support the effective implementation of VFAs. These recommendations provide actionable insights that can help improve the adoption and efficacy of VFAs in schools. By highlighting both the benefits and challenges associated with VFAs, the study sets a foundation for future research, encouraging further exploration into overcoming barriers to VFA adoption and understanding their long-term impacts on student learning outcomes.

RECOMMENDATIONS

To enhance virtual formative assessments in Bahrain's high schools, key recommendations include continuous professional development for educators, infrastructure investment for equitable technology access, collaboration with policymakers to integrate virtual formative assessments into the curriculum, fostering a culture of educator collaboration, and ongoing research to assess the impact on student outcomes. These measures aim to create inclusive, student-centered learning environments conducive to academic success in the digital age.

LIMITATIONS OF THE STUDY

While this study provides valuable insights into the impact of virtual formative assessments (VFAs) on high school students' academic achievement in Bahrain, several limitations must be acknowledged. First, the research relies on self-reported data from students, which may be subject to biases such as social desirability and recall bias. Students might overstate or understate their experiences and perceptions of VFAs, affecting the accuracy of the findings.

Second, the study is cross-sectional, capturing a snapshot of students' perceptions and academic performance at a single point in time. This design limits the ability to infer causality or observe changes and trends over time. Longitudinal studies would be more effective in understanding the long-term impacts of VFAs on academic achievement and motivation.

Third, the sample, while sizeable at 385 students, is limited to high school students in Bahrain. As a result, the findings may not be generalizable to other educational contexts, such as different age groups, regions, or countries with varying educational systems and technological infrastructures. Future research could benefit from including a more diverse and representative sample to enhance the generalizability of the results. Additionally, the study does not account for potential confounding variables that might influence academic achievement, such as socioeconomic status, prior academic performance, or access to technological resources at home. These factors could affect students' experiences with VFAs and their academic outcomes, and controlling for them in future studies would provide a more nuanced understanding of the impact of VFAs.

Lastly, the study's focus on quantitative data through surveys limits the depth of understanding regarding students' experiences and perceptions. Qualitative methods, such as interviews or focus groups, could complement the quantitative findings by providing richer, more detailed insights into how students interact with VFAs and the specific challenges and benefits they perceive.

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