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Teachers' Perceptions of the Feasibility of Using Generative Artificial Intelligence in Developing Multiple-Choice Questions for Formative Assessment in Saudi Arabia

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Abstract. Formative assessment is instrumental in improving instructional effectiveness and fostering students' ongoing learning and academic development. With the accelerating development of digital technologies, generative artificial intelligence (GAI) has recently arisen as a promising educational tool that can support teachers in designing assessment tasks, particularly through the automated generation of multiple-choice questions (MCQs). Such technologies have the potential to enhance efficiency, provide diverse assessment items, and support more dynamic evaluation practices. However, despite the increasing attention given to artificial intelligence applications in education, empirical research exploring teachers' perceptions of the practicality and feasibility of using generative AI for formative assessment remains comparatively limited, especially within the context of the Saudi educational system. Accordingly, this study sought to examine teachers' perspectives of the feasibility of employing generative artificial intelligence (GAI) to develop multiple-choice questions (MCQs) that support formative assessment practices in Saudi high schools. To achieve this objective, the study was conducted using a quantitative

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descriptive survey design. Data was gathered through a structured survey instrument distributed to a sample of 40 secondary school teachers in the Al-Baha region. The collected responses were subsequently examined using descriptive statistical techniques to determine educators' perspectives regarding the use of generative AI in assessment development. The findings indicate that teachers commonly perceive generative AI as a potentially significant tool for supporting formative assessment, particularly in improving assessment efficiency and generating diverse question items. However, participants also reported several challenges, including limited technical skills, insufficient training, and ethical approval associated with AI use in education. The findings underscore the importance of professional development and institutional support in promoting the responsible and effective integration of AI technologies within educational assessment practices.

Keywords: Artificial Intelligence (AI); formative assessment; multiple-choice questions; evaluation; King Khalid University

1. Introduction

Formative assessment has become a crucial part of effective teaching and learning in contemporary educational environment with recent studies having emphasized that it supports continuous monitoring of students' understanding, enabling teachers to provide timely feedback and adapt instructional strategies to enhance learning outcomes. (Carless & Winstone, 2023; Panadero et al., 2018). In contrast to summative assessment, which primarily assesses students' learning outcomes at the conclusion of an instructional period., assessment for learning functions as a continuous process that guides teaching practices and promotes students' active engagement in learning. Through continuous feedback and adaptive instructional strategies, it improves learner engagement, supports self-regulated learning, and contributes to improved academic performance.

Teaching is widely recognized as the cornerstone of the educational process because it involves purposeful instructional practices designed to promote critical thinking, creativity, and meaningful learning experiences. Within this process, assessment plays a fundamental role in determining the degree to which intended learning outcomes are achieved. Educational evaluation therefore represents a vital component of effective teaching, as it provides systematic evidence about students' learning progress and the effectiveness of instructional practices. Well-designed assessment strategies allow educators to identify students' strengths and weaknesses while also evaluating the effectiveness of teaching methods (Brookhart, 2017; Wiliam, 2018). When assessment practices accurately measure students' learning, teachers can make informed instructional decisions that improve the quality of education.

Educational assessment is generally categorized into summative and formative approaches. Summative assessment is performed at the completion of an instructional period to identify the degree of students' achievement of the intended learning outcomes and predetermined learning objectives whereas, in contrast, formative assessment occurs throughout the learning process and

focuses on monitoring students' understanding, providing feedback, and guiding instructional adjustments (Carless & Winstone, 2020). Effective formative assessment practices help teachers identify learning gaps, provide constructive feedback, and adjust teaching approaches to better mee learners' needs. Moreover, assessment for learning actively involves students in the educational process, which promotes students' motivation, engagement, and autonomous learning. (Panadero et al., 2018; Wiliam, 2018).

Over the past few years, technological advancements have facilitated the utilization of artificial intelligence (AI) in teaching and learning environments with AI-driven technologies increasingly used to facilitate adaptive learning systems, automated feedback, and data-informed instructional decision-making. Research suggests that AI-based learning tools can personalize instruction, provide adaptive feedback, and improve instructional efficiency by responding to students' personal learning needs and learning preferences (Holmes et al., 2023; Zawacki-Richter et al., 2019). In addition, machine learning techniques enable educators to process substantial amounts of data, predict students' academic achievement, and enhance instructional planning, making AI technologies particularly valuable for supporting formative assessment practices (Chen et al., 2020).

More recently, advances in generative artificial intelligence (GAI) have opened new possibilities for educational content development, including the automated generation of assessment items such as multiple-choice questions (MCQs). Generative AI tools can support teachers in creating various and contextually relevant assessment questions aligned with learning objectives. These technologies can reduce teachers' workload, increase the variety of assessment items, and support more efficient formative assessment practices (Kasneci et al., 2023; Tlili et al., 2023). However, in spite of the increasing scholarly interest in AI-supported education, much of the existing research has focused on learning analytics, intelligent tutoring systems, and students' interaction with AI-based learning tools while comparatively limited attention has been given to educators' perspectives on the feasibility of utilizing generative artificial intelligence (AI) to develop formative assessment items, particularly multiple-choice questions.

This gap is especially significant in the context of the Kingdom of Saudi Arabia (KSA), Educational reforms aligned with Vision 2030 emphasize the utilization of advanced technologies and innovation in education. Although AI applications in education are receiving increasing scholarly attention, empirical research examining teachers' perceptions of generative AI-supported assessment design remains limited in Saudi secondary education. Therefore, the study is sought to examine educators' perspectives regarding the feasibility of using generative artificial intelligence to develop multiple-choice questions (MCQs) for formative assessment in Saudi secondary schools. Understanding teachers perceived benefits and challenges related to generative AI can provide a deeper understanding of the responsible and effective integration of AI technologies in educational assessment practices.

1.1 Research Questions

To address the identified gap in literature, the present study is guided by the following research questions:

1. What are teachers' perceptions of the feasibility of using generative artificial intelligence to develop multiple-choice questions (MCQs) for formative assessment in Saudi high schools?
2. What benefits do teachers perceive in using generative artificial intelligence for generating multiple-choice questions in formative assessment?
3. What challenges do teachers encounter when using generative artificial intelligence to develop multiple-choice questions for formative assessment?

2. Literature Review

2.1 First Theme: Generative Artificial Intelligence

Generative artificial intelligence (GAI) represents a rapidly evolving technological domain that enables modern systems to simulate and replicate aspects of human cognitive abilities. In practical terms, GAI reflects the interaction between human intelligence—characterized by perception, experience, reasoning, and adaptability—and artificial systems designed through human creativity and computational processes (Baidoo-Anu et al., 2024).

Unlike natural human cognition, artificial intelligence operates through programmed algorithms and data-driven models that enable machines to carry out complex tasks conventionally requiring human cognition, such as reasoning, critical thinking and problem solving, content generation, and decision processes (Järvelä et al., 2023). Recent advances in machine learning, deep learning, and large language models have significantly expanded the capabilities of generative artificial intelligence (GAI), positioning it as a transformative technology with growing applications across education, research, and professional practice.

2.1.1 Definition of Artificial Intelligence

Generative artificial intelligence (GAI) has been defined in different ways in the literature, yet most definitions emphasize core capabilities such as machine learning, reasoning, and adaptability. Broadly speaking, GAI is a specialized field of computer science focusing on developing systems that can imitate aspects of human intelligence, including learning, language use, and problem-solving. Scholars have also highlighted the capacity of intelligent programs to learn from data and adjust to new or unfamiliar scenarios, reflecting processes similar to human cognition. In this context, GAI has been described as the advancement of expert systems that replicate human cognitive abilities and operational abilities While other researchers stress its capacity for experiential learning and intelligent adaptation. Within the broader technological transformation, GAI is widely regarded as a central driver of the Fourth Industrial Revolution and emerging digital innovations.

Recent studies indicate that artificial intelligence (AI) can support adaptive instruction and promote personalized learning environments. Through the automation of repetitive tasks, including grading and feedback, AI reduces teachers' administrative responsibilities, enabling educators to place greater

emphasis on higher-order instructional strategies and meaningful student engagement (Holmes et al., 2023; Zawacki-Richter et al., 2019).

2.1.2 Classifications of Artificial Intelligence

Artificial intelligence (AI) has been categorized into several domains, with generative artificial intelligence (GAI) receiving growing scholarly attention due to its advanced computational and creative capabilities. Definitions of AI commonly reflect academic, cognitive, technological, and boundary-oriented perspectives, illustrating the broad theoretical scope of the field. From an applied and academic standpoint, Järvelä et al. (2023) underscore the functional aspects of AI, including learning, speech processing, planning, and problem-solving, emphasizing its practical relevance. Similarly, Liang et al. (2025) defines AI as the simulation of human cognitive and motor processes, suggesting that artificial systems can replicate certain forms of human expertise.

Other scholars, such as Russell and Norvig (2021) and Liang et al. (2025), emphasize artificial intelligence's capacity to simulate reasoning, learning, and adaptive decision-making mechanisms. These capabilities enable AI systems to analyze large datasets and identify meaningful patterns and generate intelligent responses that support complex problem-solving. Within the broader technological landscape, Schwab (2017) positions artificial intelligence as a crucial driver of the Fourth Industrial Revolution (Industry 4.0), highlighting its transformative impact across economic, educational, and technological sectors. Overall, generative artificial intelligence can be described as a machine-learning-based technology that enhances human creativity, facilitates knowledge production, and supports innovation when applied within responsible and ethical frameworks.

2.1.3 Types of Artificial Intelligence

Throughout the past several decades, artificial intelligence (AI) has developed swiftly as researchers strive to simulate core human cognitive functions, including learning and reasoning, and communication through computational systems. By designing machines capable of performing tasks that typically require human intelligence, AI has emerged as a transformative technology across multiple sectors, including healthcare, education, and industry. Artificial intelligence (AI) is generally categorized into three major types according to its capabilities and functional scope: narrow (weak) AI, general (strong) AI, and superintelligent AI.

Narrow AI refers to systems developed to perform specific tasks within a restricted domain through the use of predefined algorithms and data-driven models. Examples of such systems include voice assistants, recommendation systems, and other applications designed to perform targeted functions efficiently. In contrast, general AI represents a more advanced form of intelligence that seeks to replicate human cognitive abilities, enabling systems to learn from experience, adapt to changing situations, and perform diverse tasks across multiple domains Super AI, which remains largely theoretical and experimental, refers to a level of intelligence that exceeds human cognitive capabilities across multiple domains. This form of AI is often described as transcending human intellectual capacity and may bring about profound technological advancements

while simultaneously raising significant ethical, philosophical, and safety concerns. Understanding these classifications is essential for guiding responsible AI research and development while maintaining that technological innovation continues to adhere to ethical principles and broader societal benefits.

2.1.4 Importance of Artificial Intelligence in Education

Artificial intelligence (AI) is increasingly reshaping education by enabling personalized and adaptive learning environments across educational institutions. Through advanced data analysis and intelligent algorithms, AI systems can support educators in identifying students' learning needs, monitoring performance, and addressing individual students' learning gaps. In addition to administrative functions, Artificial intelligence assists teachers by automating routine tasks such as grading, feedback generation, and data management, thereby reducing administrative workload and enabling educators to focus on more meaningful pedagogical practices, including fostering creativity, critical thinking, and student engagement. (Brookhart, 2017).

AI-driven learning platforms can also adjust instructional materials, learning pace, and pathways according to students' abilities and preferences, which may enhance motivation and improve academic performance. However, the effective integration of artificial intelligence (AI) in education relies on well-designed instructional strategies, sustained professional development for teachers, and careful attention to ethical considerations, including data privacy, transparency, equity, and financial implications. When applied responsibly, AI can act as a significant driver of innovation and enhance the quality of modern educational systems.

2.2 Applications for Artificial Intelligence

Artificial intelligence (AI) is expanding rapidly reshaping education by enabling smarter, more individualized learning in a more efficient and engaging manner. Main AI applications (for instance, expert systems, machine learning algorithms, AI-driven natural language processing (NLP) as well as immersive technologies, including virtual and augmented reality technologies enable adaptive learning, automated assessment, and interactive educational experiences. These technologies have not only benefited teachers but also reduced their administrative and instructional workloads. But achieving the full scope of AI in education is contingent upon a strategic curriculum-driven integration, ongoing professional development, and ongoing adaptation to emerging pedagogical and tech-driven needs.

2.3 Characteristics of Generative Artificial Intelligence

Artificial intelligence (AI) is increasingly reshaping contemporary education by offering innovative solutions that enhance teaching effectiveness, learning experiences, and educational outcomes. personalization, instruction, and student engagement. Central AI applications, such as expert systems, machine learning, natural language processing (NLP), and virtual and augmented reality technologies, also afford adaptive learning environments, automated assessment, and experiential learning in response to individual students' needs. Beyond facilitating pedagogical progress, AI technologies help lighten teachers'

administrative load, thereby increasing focus on pedagogical originality and genuine learner engagement. To fully harness the transformative potential of artificial intelligence (AI) in education, adoption should be planned with strategic curriculum integration, continuous professional development for staff, and a willingness to adapt.

2.4 Second Theme: Formative Assessment

While summative assessment evaluates learning outcomes at the end of an instructional unit, formative assessment focuses on monitoring students' progress and providing continuous feedback throughout the learning process. As an integral component of everyday classroom practice, it plays a crucial role in effective teaching by offering real-time feedback that guides instructional practices and supports students' ongoing learning. Based on Ausubel's theory of meaningful learning, formative assessment focuses on integrating new knowledge into learners' cognitive structures to foster deeper understanding and lasting learning. With modern educational paradigms favoring learning processes over summaries of learning outcomes, formative assessment is widely recognized as an important pedagogical approach that enhances student engagement, facilitates the achievement of learning objectives, and promotes equity in learning opportunities. (Black & Wiliam, 1998; McMillan, 2013).

2.4.1 Importance of Formative Assessment

Formative assessment plays a crucial role in improving the quality of teaching and learning and has become a central component of student evaluation in many advanced educational systems. It is widely used to monitor students' learning progress, provide timely feedback, and guide instructional improvement. For example, in Germany, subject teachers assess students' performance through continuous classroom assignments and periodic examinations conducted throughout the academic year while in the United Kingdom, formative assessment often involves systematic documentation of students' progress through learning portfolios. Similarly, in Japan, teachers conduct assessments every four to six weeks to evaluate students' development based on their previous performance rather than comparing them with peers.

In France, assessment practices include various formative tasks such as research activities, reports, and projects, accompanied by detailed qualitative feedback that clarifies grading decisions. In the United States, formative assessment incorporates diverse assignments, projects, and research activities designed to support instructional objectives and classroom learning needs. Recent studies also highlight the growing importance of formative assessment in digital and online learning environments. (Brookhart, 2017). By identifying students' strengths and weaknesses, formative assessment supports targeted instruction, encourages self-regulated learning, and improves overall learning outcomes through continuous feedback and instructional adaptation.

2.4.2 Purposes of Formative Assessment

Formative assessment plays a crucial role in enhancing the educational process by moving beyond merely measuring students' learning levels to support deeper understanding and continuous improvement in learning. According to Brookhart

(2017), formative assessment serves several important pedagogical functions that directly support both teaching and learning. It enables teachers to identify students' strengths and areas for improvement, monitor learning progress regularly, and assess the extent to which instructional objectives are being achieved. The information gathered through formative assessment allows educators to adjust instructional strategies, adopt alternative teaching approaches, and implement timely remedial support tailored to students' abilities and learning needs.

Furthermore, it provides timely and constructive feedback to both teachers and students, enhancing instructional practices and sustaining students' engagement in the learning process. Beyond its direct instructional value, formative assessment also strengthens students' motivation and sense of responsibility for their own learning. When students clearly understand their learning gaps, they become more aware of how to improve their performance and develop greater autonomy and self-regulation. Furthermore, it also promotes inclusive and differentiated instruction by addressing individual learning differences, offering enrichment opportunities for advanced learners while providing additional support for those who face learning challenges.

Overall, formative assessment serves as a dynamic and responsive component of effective teaching and learning, enabling educators to monitor students' progress, adjust instructional strategies, and support continuous academic development. (Brookhart, 2017).

2.4.3 Reasons for Using an E-Learning Environment with Formative Assessment

Rapid technological advancement has made e-learning environments an essential component of contemporary education, enhancing both learning efficiency and instructional flexibility. When integrated with formative assessment, these environments provide substantial pedagogical benefits by enabling continuous interaction, monitoring, and feedback between teachers and students. This integration enriches the learning process and helps address persistent challenges in large classrooms, particularly the difficulty of providing immediate and individualized feedback. Through digital platforms, teachers can monitor students' progress, identify learning gaps, and deliver timely feedback that supports personalized and interactive learning experiences.

In traditional large-class settings, formative assessment often becomes less effective, however, because teachers may struggle to provide meaningful feedback or maintain continuous communication with every learner. Such limitations increase instructional pressure on teachers and may negatively influence students' academic performance and engagement. E-learning environments help mitigate these challenges by facilitating flexible communication channels and continuous assessment practices. Furthermore, these environments promote active student engagement in the learning process, thereby enhancing motivation and reducing the monotony often associated with traditional teaching methods. Additionally, interconnected digital platforms support collaboration, lifelong learning, and continuous self-development

(Schwab, 2017). Consequently, implementing formative assessment within e-learning environments promotes more effective, engaging, and learner-centered educational experiences.

2.5 Previous Studies

In recent years, generative artificial intelligence (GAI) has emerged as a transformative component of contemporary educational systems, offering significant opportunities to enhance teaching practices and support more personalized learning experiences. Through capabilities such as adaptive learning environments, automated content generation, and real-time feedback, GAI enables educators to design more responsive and student-centered instructional approaches, thereby improving both teaching effectiveness and learner engagement (Zawacki-Richter et al., 2019; UNESCO, 2021). As educational institutions continue to embrace digital transformation, AI-driven tools are increasingly recognized as valuable resources for instructional design, formative assessment, and data-informed decision-making processes.

A growing body of research has examined the integration of artificial intelligence in education, highlighting both its pedagogical potential and the challenges associated with its implementation. While AI technologies have the capacity to reshape learning environments, their successful adoption depends largely on institutional readiness, strategic planning, and sustained professional development for educators. Within the Saudi educational context, recent studies indicate that although institutions are actively investing in digital infrastructure in alignment with Vision 2030, the effective use of AI in teaching and assessment remains influenced by factors such as teacher preparedness, training opportunities, and institutional support mechanisms.

Overall, the literature suggests that educators' perceptions of AI adoption—including the feasibility of using generative AI for developing multiple-choice questions (MCQs) in formative assessment—vary according to contextual and institutional conditions. Key enabling factors include robust technological infrastructure, strong administrative leadership, continuous professional development, and clear institutional policies that guide ethical and pedagogically sound AI use. At the same time, persistent challenges—such as limited technical expertise, resource constraints, and concerns about reliability and academic integrity—continue to shape adoption patterns. Nevertheless, the literature consistently affirms that generative AI holds substantial transformative potential for enhancing assessment practices, provided that its implementation is supported by balanced strategies, teacher readiness, and well-developed institutional capacity (UNESCO, 2021).

3. Methodology

3.1 Research Design

The present study utilized a descriptive survey research design to examine teachers' perceptions of the feasibility of using generative artificial intelligence (GAI) to develop multiple-choice questions (MCQs) for formative assessment in Saudi secondary schools. The descriptive survey approach is widely used in

educational research because it enables researchers to systematically collect data describing participants' attitudes, perceptions, and practices related to a particular phenomenon (Creswell & Creswell, 2018). This method is appropriate for exploring contemporary educational trends and understanding teachers' perspectives on integrating emerging technologies into instructional and assessment practices.

To achieve the objectives of the study, a mixed-methods approach was adopted, using a combination of quantitative and qualitative data. Quantitative data were gathered using a structured survey instrument developed to assess teachers' levels of use, technical competencies, and perceptions regarding the implementation of a generative artificial intelligence in formative assessment. The responses provided measurable insights into teachers' attitudes and the perceived practicality of AI-assisted assessment design.

Additionally, qualitative research data were obtained through participants' participants' responses to open-ended questionnaire questions, allowing participants to share their valuable understanding, perspectives, and concerns regarding AI integration in educational assessment. Combining quantitative findings with qualitative insights provided a more holistic understanding of the central research issue and enhanced the validity and the depth of the study findings (Creswell & Creswell, 2018).

3.2 Research Population and Sample

The research population represents the complete group of individuals who are directly related to the research problem and from whom the data required to achieve the objectives of the study are obtained. In the present study, the research population comprises all male and female secondary school teachers in the Al-Baha region who are directly involved in the educational context under investigation and meet the established participation criteria.

These teachers represent the target group from which data were collected to explore the phenomenon addressed in the research. Clearly defining the research population is essential to enhance the validity and reliability, and generalizability of the study findings. From this population, a random sample of 40 teachers was selected to participate in the study. Random sampling ensured that each member of the population had an equal probability of selection, thereby reducing sampling bias and enhancing the representativeness of the collected data (Creswell & Creswell, 2018).

3.2.1 Demographic Characteristics of the Research Sample

To describe the demographic characteristics of the study sample based on the selected variables, frequencies and percentages were calculated. Years of teaching experience were included as a key variable due to its relevance to professional practice and informed judgment. Focusing on this variable contributes to a clearer understanding of the sample's suitability for examining teachers' perceptions and practices.

a) Years of experience

Table 1 presents the distribution of the research sample according to years of teaching experience (N = 40).

Table 1: Distribution of Participants According to Years of Experience (N = 40)

Years of Experience	Frequency (f)	Percentage (%)
Less than 5 years	5	12.5%
From 5 to less than 15 years	11	27.5%
From 15 years and more	24	60.0%
Total	40	100%

Table 1 presents the distribution of the study sample by years of teaching experience (N = 40).The figures also suggest that a substantial portion of the class (60.0%) has at least 15 years of work experience, implying that highly experienced teachers are prevalent in the sample, while 27.5% of participants have 5–15 years' experience, and 12.5% have less than 5 years' experience. The distribution indicates that the study's outcome is informed in part by veteran educators, who can produce responses that are more informed and reflective than those in most research, based on their perceptions and practices.

Creswell and Creswell (2018) also suggest that, by selecting data from professionals who have gained considerable professional experience, descriptive survey findings increase credibility and depth, by providing data from more advanced participants who have had extensive exposure to the field, and whose practices and innovations may offer better opportunities to interrogate how educators perform in their work environments. Nevertheless, in interpreting the findings, the somewhat smaller number of junior teachers may not be well-represented, particularly when generalizing across career stages (Fraenkel et al., 2019).

b) Academic qualification

Table 2: Frequency and Percentage Distribution of Participants According to Academic Qualification (N = 40)

Academic Qualification	Frequency(f)	Percentage (%)
Bachelor's Degree	23	57.5%
Master's Degree	14	35.0%
Doctorate (PhD)	3	7.5%
Total	40	100%

Table 2 indicates that the majority of participants hold a bachelor's degree (57.5%), followed by those with a master's degree (35.0%), while a smaller proportion possess a doctoral degree (7.5%). This distribution reflects a sample with varied academic backgrounds, which is beneficial for capturing diverse professional perspectives and enhancing the robustness of the study's results. Including participants with different qualification levels is recommended in educational research to improve representativeness and strengthen the validity of interpretations (Cohen et al., 2018; Creswell & Creswell, 2018).

3.3 Research Instrument

The questionnaire was constructed after a comprehensive examination of relevant theories, academic literature, and prior empirical studies to ensure content validity and consistency with the study objectives. It was composed of two sections: the first focused on participants' background information (gender, teaching experience and academic qualifications), and the second covered three dimensions, namely, teachers' use of artificial intelligence in generating multiple-choice questions for formative assessment, their skills and competencies in appropriately applying AI tools, as well as their perspectives on the advantages of using generative AI in assessment practices. This systematic methodology enabled a detailed analysis of participants' characteristics and key determinants of AI integration in educational assessment in the Al-Baha region, consistent with survey research and instrument development guidelines (Creswell & Creswell, 2018; DeVellis, 2017).

3.3.1 Construct Validity of the Research Instrument

Construct validity was assessed by calculating the correlation coefficients between each questionnaire item and the total score of its corresponding dimension. This approach guaranteed that each of these items played a meaningful role in measuring the construct it was purposively designed to represent. The results revealed statistically significant and acceptable item–total correlations demonstrating that the items are consistently measuring the intended construct. These results support the conclusion that the research instrument adequately represented the underlying dimensions of the study variables and demonstrated adequate construct validity (Field, 2018; Pallant, 2020).

Table 3: Pearson Correlation Coefficients Between Each Item and the Total Score of the First Section

Item Number	Pearson Correlation Coefficient	Item Number	Pearson Correlation Coefficient
1	0.680**	15	0.917**
2	0.740**	16	0.823**
3	0.573**	17	0.888**
4	0.837**	18	0.913**
5	0.705**	19	0.727**
6	0.816**	20	0.789**
7	0.853**	21	0.812**
8	0.890**	22	0.742**
9	0.875**	23	0.648**
10	0.871**	24	0.767**
11	0.767**	25	0.869**
12	0.736**	26	0.768**
13	0.630**	27	0.732**
14	0.671**	…	….

Table 3 presents the Pearson correlation coefficients between each questionnaire item and the total score of the first dimension of the questionnaire.The results reveal that all items are positively and statistically significantly correlated with

the total score at the 0.01 level ()**, with coefficients ranging from 0.573 to 0.917. The correlation values surpassed the commonly accepted criterion of 0.30 for item–total correlations, confirming that the questionnaire items are suitably related to the constructs they were designed to measure. The high correlation coefficients observed across the items reflect a substantial level of internal consistency, indicating that the items collectively measure the same underlying construct. These findings offer strong empirical evidence supporting the construct validity of the first section of the research instrument. Therefore, all items were retained for further statistical analysis, as their correlations demonstrate appropriate coherence with the dimension, they are intended to assess (DeVellis, 2017; Hair et al., 2019).

3.3.2 Reliability of the Research Instrument

Cronbach's alpha coefficient was calculated for each dimension of the questionnaire to assess the internal consistency and reliability of the measurement instrument. This coefficient is widely recognized as a reliable indicator of the degree to which items within a scale are interrelated and consistently measure the same underlying construct (Cronbach, 1951; Tavakol & Dennick, 2011). In the present study, Cronbach's alpha was applied to examine the reliability of responses obtained from the survey participants. The results reported in the table show alpha values ranging from acceptable to high levels, indicating strong internal consistency among the items and confirming the suitability of the questionnaire for use in this study.

Table 4: Cronbach's Alpha Coefficients for the Study Sections

Dimension	Number of Items	Cronbach's Alpha Value
Artificial Intelligence Use in Education and Formative Assessment from Teachers' Perspectives	8	0.811
Availability of Necessary Skills Among Teachers to Use AI Technology in Formative Assessment	8	0.802
The Impact of Artificial Intelligence on Education and Formative Assessment	9	0.834
Overall Questionnaire Score	25	0.847

Table 4 presents the internal consistency reliability of the questionnaire by reporting Cronbach's alpha coefficients for each section of the instrument and for the overall scale. The alpha values for the three sections range from 0.802 to 0.834, all of which exceed the widely accepted reliability benchmark of 0.70, indicating a satisfactory level of reliability in educational research. These results suggest that the items within each section demonstrate adequate homogeneity and consistently measure the intended constructs.

Furthermore, the overall questionnaire yielded a Cronbach's alpha coefficient of 0.847, reflecting a high level of internal consistency across the 25 items included in the instrument. Collectively, these findings confirm that the research instrument is both reliable and suitable for examining teachers' use of artificial

intelligence, their competencies in applying AI for formative assessment, and the perceived benefits of AI within educational settings (Cronbach, 1951; Tavakol & Dennick, 2011).

3.4 Statistical Methods Used

The gathered data were analyzed using a combination using both descriptive and inferential statistical methods to facilitate a comprehensive understanding of the study findings. Descriptive Analysis of the Data (frequencies, percentages, and means) were utilized to summarize sample features and participants' responses. The construct validity of the measurement instrument was established by calculating Pearson's correlation coefficients to assess the relationships between individual items and their corresponding constructs. Reliability was assessed using Cronbach's alpha coefficient, a widely recognized indicator of the internal consistency and stability of the measurement instrument. By employing a combined statistical approach to the above methods, this research ensured a systematic, rigorous, and reliable analysis of the resulting data (Cronbach, 1951; Field, 2018; Pallant, 2020).

3.4.1 Data Analysis Methods

Table 5: Levels and Degrees of Agreement on the Five-Point Likert Scale

Coding Value (Relative Weight)	Average Range	Judgment Criterion on Results
1	1.00–1.80	Very Low
2	1.81–2.60	Low
3	2.61–3.40	Moderate
4	3.41–4.20	High
5	4.21–5.00	Very High

Participants' responses were analyzed to address the research questions. and to verify the study objectives based on the data collected through the research instrument. Following the processes of data coding and entry, the dataset was analyzed using the Statistical Package for the Social Sciences (SPSS) . Descriptive statistical techniques were applied to summarize and interpret the participants' responses. Descriptive statistics, including frequencies and percentages, were used to describe the demographic characteristics of the respondents, while arithmetic means were calculated to determine the levels of responses across the study variables, dimensions, and questionnaire items. This procedure enabled the researcher to identify whether participants' perceptions reflected relatively high or low levels concerning the constructs examined in the study.

In addition, standard deviation values were computed to measure the degree of dispersion around the mean, where lower standard deviation values indicate greater consistency and homogeneity among respondents' answers. Pearson's correlation coefficient was used to examine the relationships between questionnaire items and their corresponding dimensions, thereby supporting the construct validity of the instrument. Additionally, Cronbach's alpha coefficient was calculated to assess the internal consistency and reliability of the research instrument, ensuring the stability

and dependability of the measurement tool (Field, 2018; Pallant, 2020; Tavakol & Dennick, 2011).

3.4.2 Qualitative Data Analysis

In addition to the quantitative statistical analysis, qualitative data obtained from participants' open-ended questionnaire responses were analyzed to gain deeper insights into teachers' perceptions of using artificial intelligence in formative assessment. This analysis enabled the researchers to capture participants' experiences, reflections, and perspectives that could not be fully represented through numerical data alone. Integrating both quantitative and qualitative findings therefore provided a more comprehensive understanding of teachers' views on the role of artificial intelligence in supporting formative assessment practices. The qualitative data were analyzed using a thematic analysis approach, which involves the systematic identification, analysis, and interpretation of patterns within textual data.

Initially, all responses were carefully reviewed and organized to ensure familiarity with the dataset. Meaningful statements reflecting teachers' experiences, attitudes, and perceived benefits or challenges related to the use of generative AI in assessment practices were then identified and coded. These codes were subsequently grouped into broader thematic categories representing recurring ideas and shared perspectives across participants' responses. Finally, the themes that emerged from the qualitative analysis were interpreted in alignment with the study's objectives to complement and provide context for the quantitative findings. Integrating qualitative insights with statistical findings enabled the researchers to develop a deeper and more comprehensive understanding of teachers' perceptions, experiences, and practices regarding the use of AI-assisted formative assessment in educational settings (Creswell & Creswell, 2018).

3.5 Data Analysis

Data for this study were gathered through a structured survey instrument administered to secondary school teachers. After collection, the responses were processed and analyzed using the Statistical Package for the Social Sciences (SPSS). To interpret the data, descriptive statistical techniques were applied, including frequencies, percentages, means, and standard deviations. These statistical indicators enabled the researchers to summarize participants' responses and identify general patterns in teachers' perceptions regarding the feasibility and practical use of generative artificial intelligence in designing multiple-choice questions (MCQs) for formative assessment.

The reliability of the measurement instrument was assessed by examining its internal consistency using Cronbach's alpha coefficient, a commonly accepted technique for evaluating the reliability of survey instruments in educational research (Field, 2018). In addition, the descriptive statistical findings were interpreted using a five-point Likert scale, where ranges of mean scores were applied to categorize the levels of participants' agreement and perceptions. This analytical approach facilitated a clearer and more systematic understanding of

teachers' attitudes and viewpoints regarding the integration of generative artificial intelligence in formative assessment practices.

3.6 Ethical Considerations

The research was conducted in accordance with established ethical principles commonly applied in educational research. Participation was entirely voluntary, and all respondents were clearly informed about the objectives and purpose of the study prior to completing the questionnaire. Informed consent was obtained from all participating teachers, and they were assured that their identities and responses would remain anonymous and confidential. Participants were also informed of their right to withdraw from study at any time without penalty. Furthermore, all collected data were used exclusively for academic research purposes and were managed in compliance with recognized ethical standards for research practice.

4. Results and Findings

4.1 Results Addressing Research Question 1

A descriptive statistical analysis was conducted to examine whether secondary school teachers in the Al-Baha region use artificial intelligence to generate multiple-choice questions (MCQs) that can be utilized for formative assessment purposes, allowing educators to assess students' understanding, identify learning gaps, and provide timely feedback to support the teaching and learning process. Within the first dimension of the questionnaire, descriptive statistical measures, namely the arithmetic mean, standard deviation, item ranking, and levels of agreement, were computed for each item to analyze participants' responses and identify overall response patterns.

The descriptive measures outlined here painted a clear quantitative portrait of teachers' utilization patterns and perceptions about AI-assisted question construction. Additionally, the analysis facilitated a nuanced interpretation of the data by demonstrating both the extent of AI adoption and the variability of responses among participants, and by highlighting trends and differences in the use of AI tools in formative assessment (Creswell & Creswell, 2018; Pallant, 2020). The findings of the analysis are presented in the following section.

Table 6: Means, Standard Deviations, and Rankings of Items for Axis One

Item No	Statement	Mean	Standard Deviation	Rank	Degree of Agreement
1	Generative AI is what I use to provide increased interaction between students and educational content.	3.82	0.958	8	High
2	Using formative assessment elements, I use AI applications throughout my teaching.	3.95	0.959	3	High
3	Using AI facilitates group discussions with students during formative assessment.	4.05	1.011	2	High
4	Generative AI helps me understand students' abilities through electronic assignments they submit.	3.95	1.061	4	High
5	In this way, I save both time and effort by utilizing AI for formative assessment	4.18	0.931	1	High
6	AI plays a significant role in preparing oral tests that I use in formative assessment	3.88	1.067	7	High
7	AI-generated written tests are more engaging and clearer for students.	3.93	1.095	6	High
8	Leveraging AI allows me to create electronic portfolios through which I conduct formative assessment.	3.95	0.986	5	High
Overall Mean		3.96	1.01	High	

Table 6 presents the arithmetic means and standard deviations., and rankings of the questionnaire items related to teachers' use of generative artificial intelligence (AI) in formative assessment practices. The overall mean score (M = 3.96) reflects a high level of agreement among participants, indicating that teachers generally demonstrate positive perceptions toward the integration of AI tools in formative assessment processes. These results suggest that educators recognize the potential value of generative AI in supporting assessment design and enhancing ongoing evaluation of students' learning. This finding implies that AI is increasingly recognized as a supportive technology that can enhance teaching effectiveness and assessment procedures.

The highest-rated item (Item 5, M = 4.18, SD = 0.93) reflects strong agreement among teachers that the use of AI in formative assessment helps save time and effort, highlighting its potential to streamline instructional tasks and reduce teachers' workload. Similarly, Item 3 (M = 4.05, SD = 1.01) indicates that AI can facilitate group discussions and collaborative learning during formative assessment activities. Other items, including the use of AI to assess students through electronic assignments and monitor learning progress (M = 3.95), also

received high ratings, demonstrating teachers' recognition of AI's diagnostic value in providing timely and evidence-based feedback.

Although the items related to the preparation of oral and written assessments recorded slightly lower mean scores (M = 3.88–3.93), they nevertheless remain within the high agreement category. This indicates that teachers generally maintain favorable attitudes toward employing generative AI in these assessment tasks. Overall, the findings suggest that educators perceive generative artificial intelligence as a valuable resource that can effectively support and enhance formative, learner-centered assessment practices.

4.2 Results Addressing Research Question Two

The second research question aimed to examine the extent to which teachers in the Al-Baha region possess the necessary skills to employ artificial intelligence technologies in developing multiple-choice questions (MCQs) for formative assessment at the secondary school level. To address this question, descriptive statistics were used, including calculation of arithmetic means, standard deviations, item rankings, and levels of agreement for all items related to this axis. These statistical measures are widely used to summarize participants' perceptions and skill levels and to identify patterns and variations in responses within educational research contexts (Field, 2018; Pallant, 2020). The use of descriptive statistics provided a clear, systematic quantitative overview of teachers' self-reported competencies in AI-assisted assessment design, thereby supporting accurate interpretation of the findings. The results are presented in Table 7.

Table 7: Means, Standard Deviations, and Rankings of Items for Axis Two

Item No	Statement	Mean	Standard Deviation	Rank	Degree of Agreement
1	I use the computer to utilize artificial intelligence technology in formative assessment	4.10	0.982	3	High
2	I can write essays and oral questions on e-learning platforms; these are basic skills for using AI applications in formative assessment	4.05	1.037	4	High
3	I use critical thinking when creating electronic question models based on AI	4.05	1.061	5	High
4	I have acquired problem-solving skills to face any technical issues when using AI in formative assessment	4.05	1.061	6	High
5	I have the ability to work with digital learning systems to benefit from them when using AI in formative assessment	4.25	0.899	1	Very High
6	Teachers possess sufficient knowledge of educational software platforms and e-	4.23	0.920	2	Very High

	learning technologies that enable them to effectively utilize these tools in AI-supported formative assessment.				
7	I possess data collection and analysis skills to benefit from them when using AI in formative assessment	3.83	1.059	8	High
8	I can diversify questions using AI when testing students through various educational platforms	3.98	1.143	7	High
Overall Mean		4.07	1.02	High	

Table 7 presents the arithmetic means and standard deviation, item rankings, and levels of agreement for the statements related to the skills required by teachers when applying artificial intelligence (AI) in formative assessment. The overall mean score for this dimension (M = 4.07, SD = 1.02) reflects a high level of agreement among participants, indicating that teachers acknowledge the significance of having the necessary skills to effectively employ artificial intelligence technologies in formative assessment practices.

The highest-rated items relate to teachers' ability to work with digital learning systems (M = 4.25) and their proficiency in educational software platforms and e-learning technologies (M = 4.23). These results suggest that teachers have a solid technological foundation, which is fundamental to the effective use of Artificial intelligence–based assessment tools. High mean scores were also recorded for integrating computers into formative assessment and designing essay or oral questions through e-learning systems, highlighting teachers' confidence in applying digital tools to support assessment processes.

Moreover, the items related to higher-order competencies, including critical thinking, problem-solving, and the ability to design varied assessment questions using artificial intelligence, also showed high levels of agreement among participants. This finding suggests that teachers possess not only the technical proficiency required to use AI tools but also the pedagogical knowledge and cognitive capabilities necessary to develop meaningful and effective AI-supported formative assessment practices.Although data collection and analysis received slightly lower ratings, they still reflected strong agreement, suggesting an area for further professional development rather than a significant limitation. Overall, the findings demonstrate that teachers possess the technical, pedagogical, and cognitive skills required to integrate AI effectively into formative assessment practices.

4.3 Results Addressing Research Question 3

The responses related to Research Question 3—which examined teachers' beliefs regarding the use of generative artificial intelligence (GAI) in formative assessment through the development of multiple-choice questions (MCQs) among secondary school students in the Al-Baha region of Saudi Arabia. —were systematically analyzed. Descriptive statistical

techniques, including arithmetic means, standard deviations, item rankings, and levels of agreement, were employed to describe participants' attitudes toward the statements included in the third dimension of the questionnaire. The measures provided a comprehensive overview of teachers' perceptions, acceptance, and involvement with GAI tools in the context of formative assessment. Descriptive statistics are a well-known way of assessing emerging trends and differences within studies of education data (Creswell & Creswell, 2018; Pallant, 2020; Albahiri et al., 2023). Therefore, the outcomes displayed below help to capture the overall attitude of teachers toward utilizing GAI technologies in the construction of MCQs, reflecting both collective and individual tendencies on the part of respondents.

Table 8: Means, Standard Deviations, and Rankings of Items for Axis Three

Item No	Statement	Mean	Standard Deviation	Rank	Degree of Agreement
1	AI formative assessment lacks complex evaluative questions	4.40	0.778	1	Very High
2	Comprehensive of all parts of the study content	4.28	0.847	2	Very High
3	AI formative assessment lacks complex evaluative questions	4.25	0.776	3	Very High
4	AI-supported formative assessment questions are more appropriate for learners' attributes and experiences	4.08	1.071	6	High
5	AI in formative assessment helps stimulate learners' interest in evaluative activities	3.98	1.050	9	High
6	AI in formative assessment provides different interaction patterns for learners	4.18	0.844	4	High
7	AI in formative assessment facilitates the teacher's preparation of enrichment activities that support students' strengths	4.10	0.955	5	High
8	AI in formative assessment gives the teacher the opportunity to select appropriate test types according to students' abilities.	4.08	0.997	7	High
9	Generative AI enables students to complete their homework effectively and in a nontraditional way	4.03	1.143	8	High
Overall Mean		4.15	0.94	High	

Table 8 presents the descriptive statistical results for Axis Three, which examines teachers' attitudes toward the use of generative artificial intelligence (GAI) in formative assessment, particularly in the development of multiple-choice

questions (MCQs). The results indicate a high level of agreement among teachers regarding the use of GAI in this context, as reflected by the overall mean score (M = 4.15), suggesting a generally positive attitude toward integrating generative AI into formative assessment practices. This result indicates that teachers generally hold positive attitudes toward integrating GAI into formative assessment processes. The item-level analysis shows overwhelming consensus on the highest-ranked statements, indicating strong teacher endorsement of GAI effectiveness in comprehensively covering curriculum content and supporting assessment processes. The relatively low standard deviation across most items indicated considerable consistency in teachers' responses to GAI, suggesting shared beliefs about the educational benefits of GAI.

In addition, the items pertaining to learner engagement, diverse interplay, and support for enrichment activities had high mean scores, indicating teachers' understanding that GAI would support student-centered and adaptive assessment settings. These findings align with previous research highlighting the value of AI-based tools in improving the accuracy of assessment processes, increasing student engagement, and enhancing overall teaching effectiveness. (Creswell & Creswell, 2018; Pallant, 2020).

5. Discussion

The findings of the present study suggest that secondary school teachers typically perceive generative artificial intelligence (GAI) as a practical and valuable tool for developing multiple-choice questions that support formative assessment practices. Teachers reported that AI-generated assessment items help them produce diverse and well-structured questions while minimizing the time and effort typically necessary for assessment preparation. These perceptions reflect teachers' growing awareness of the capability of digital technologies to improve instructional efficiency and support more data-informed teaching practices. The positive attitudes expressed by participants further suggest that generative AI can function as a supportive instructional resource that promotes continuous assessment and contributes significantly to the development of more flexible and adaptive learning environments.

However, the findings also suggest that the successful integration of artificial intelligence in formative assessment is influenced by several contextual factors that shape its effective implementation in educational settings. Teachers' technological readiness, access to continuous professional development (CPD) opportunities, and the availability of institutional support play a vital role in shaping the effectiveness of AI adoption in educational contexts. Without adequate training and guidance, educators may encounter difficulties in using AI tools effectively or in evaluating the quality and pedagogical suitability of AI-generated assessment content. These challenges highlight the importance of establishing supportive institutional frameworks that equip teachers with adequate technological resources, ongoing professional development, and clearly articulated ethical frameworks to guide the responsible use of artificial intelligence in educational contexts. Strengthening such support systems can

improve teachers' confidence and competence in effectively integrating AI technologies into their teaching and assessment practices.

The findings of the present study align with earlier research that underscores the expanding role of artificial intelligence in enhancing formative assessment practices within educational contexts. Formative assessment is widely recognized as a continuous diagnostic process embedded within teaching and learning that enables educators to identify students' needs, adjust instructional strategies, and improve learning outcomes through timely feedback and adaptive instruction (Black & Wiliam, 1998; McMillan, 2013). Within increasingly digital learning environments, AI technologies have been identified as powerful tools capable of supporting assessment design, generating diverse question formats, and providing rapid feedback to learners (Holmes et al., 2019).

Previous studies also indicate that AI-supported assessment systems can reduce teachers' workload while improving the efficiency of instructional practices (Luckin et al., 2016). Additionally, AI technologies enable educators to analyze learner data more effectively, supporting data-driven instructional and assessment decisions, helping identify learning patterns and individual differences that may be difficult to detect using traditional assessment methods (UNESCO, 2021). Overall, the positive perceptions identified in this study are consistent with existing literature indicating that AI-supported assessment tools can improve the design of assessments and promote more learner-centered instructional practices.

6. Conclusion

This study contributes to the expanding body of literature on the use of artificial intelligence—particularly generative AI—in formative assessment by offering empirical insights drawn from the secondary education context. The findings highlight the important role of formative assessment in enhancing student learning and supporting continuous academic development by providing continuous feedback and diagnostic insights, which enable teachers to adapt and refine their instructional strategies more effectively. The results indicate that AI-supported formative assessment has the potential to enhance the efficiency of assessment practices, foster greater student engagement, and enable more personalized learning experiences that address learners' individual differences. In addition, AI-based assessment tools can facilitate more interactive learning environments by providing timely feedback that may positively influence students' motivation and academic performance.

From a pedagogical standpoint, the findings emphasize the value of learner-centered instructional approaches that build upon students' prior knowledge and learning experiences to facilitate deeper understanding. However, the study also suggests that the effective integration of AI in assessment depends on the availability of adequate teacher competencies, ethical awareness, and strong institutional readiness. Therefore, the successful implementation of AI-supported formative assessment depends on the availability of adequate technological infrastructure, continuous professional development for teachers, and well-

defined ethical guidelines and policy frameworks that ensure the responsible and sustainable use of artificial intelligence in educational contexts.

6.1 Educational and Practical Implications

The findings highlight the growing capacity of generative artificial intelligence (GAI) as a supportive tool for teachers in developing multiple-choice questions for formative assessment. AI can generate structured and diverse assessment items, improve efficiency while reduce the time and effort required for test preparation. Its use may also enhance the quality and variety of assessment tasks, promoting more engaging and interactive learning environments. To fully realize these benefits, educational institutions should ensure the availability of adequate technological infrastructure, provide continuous professional development for teachers, and establish clear ethical guidelines that support the responsible and effective integration of artificial intelligence into assessment practices.

7. Consent to Participate

Written informed consent was obtained from all participating faculty members prior to their involvement in the study. Participants were fully informed about the purpose and objectives of the research, and their participation was entirely voluntary. They were also informed of their right to withdraw from study at any time without any consequences. They were assured that their identities and responses would remain anonymous and confidential, and that all collected data would be used exclusively for academic research purposes. The study was conducted in full accordance with established ethical guidelines for research involving human participants (American Psychological Association, 2020).

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9. AI Tools for Language Enhancement

We used AI tools to improve our language. AI-based tools were used to refine the language quality of this work, as the authors reported. QuillBot was primarily used for paraphrasing and improving sentence structure and Grammarly for grammar checking, punctuation, and clarity. For all these contributions, the authors used only these tools to refine the language; all scholarly content, interpretation, and conclusions are the authors' own.

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