

Harnessing Technology to Achieve the Highest Quality in the Academic Program of University Studies

The Quality Based on ABET and NCAAA Accreditations

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Abstract—This research aims to utilize information technology to improve education quality, particularly in higher education. A key contribution of this research is the application of generative artificial intelligence, specifically ChatGPT, to validate test questions that meet both international (ABET) and local (NCAAA) academic accreditation standards. The study was conducted within the Information Systems Department's bachelor's program at King Abdulaziz University in the Kingdom of Saudi Arabia, focusing on a website development course. The custom ChatGPT application, named Question Checker, was developed to validate questions generated by instructors. These validation criteria were aligned with the accreditation requirements for technology and computer science programs, ensuring compliance with both ABET and NCAAA standards. The application was tested by validating nine questions related to Student Outcomes, demonstrating its effectiveness in supporting the educational objectives of the program.

Keywords—ChatGPT; academic accreditations; technology programs; computer science; Kingdom of Saudi Arabia; website development; NCAAA; ABET

I. INTRODUCTION

ChatGPT is a Generative Pre-trained Transformer (GPT) language model designed to generate text in response to natural language inputs. It received widespread media coverage following the launch of a free preview by OpenAI in December 2022 [1][2]. The goal of ChatGPT is to mimic human communication not only in language translation systems but also in other applications such as chatbots and virtual assistants. ChatGPT employs highly effective machine learning techniques and has been trained on extensive textual datasets, creating a robust intelligence that enables it to provide nearly flawless responses to user input. It represents a significant advancement capable of revolutionizing the way humans interact with technology, fostering more conversational and intuitive communication. ChatGPT is applied in various domains, including customer service chatbots, language translation tools, and virtual assistants. Research into its potential applications in education aims to enhance student learning and engagement [3].

In this research, we propose a cutting-edge solution to assist faculty in improving the quality of the questions they generate by incorporating ChatGPT into the question-generation process. Additionally, this study focuses on validating the correctness of questions generated by instructors. This modern method allows

teachers to easily request questions relevant to specific academic units while ensuring compliance with rigorous accreditation criteria. It benefits the education system by enabling the creation of questions adaptable to various credits and accreditations, thereby increasing productivity. Our intention is to use Bloom's Taxonomy as a roadmap to methodically construct a robust structure aligned with NCAAA [4] and ABET standards [5]. Establishing the link between Bloom's Taxonomy and the curriculum has received considerable attention and contributes positively to the creation of high-quality questions that assess student understanding [6][7][8].

This study utilized Bloom's Taxonomy to align with various academic accreditations. Subsequently, a novel approach employing ChatGPT was devised to generate questions based on shared criteria. The mapping established correlations between the requirements and contexts of diverse academic accreditations for evaluating students' knowledge through questions. This mapping, which uses Bloom's Taxonomy verbs to gauge different knowledge levels, facilitated the selection of appropriate verbs for questions based on accreditation needs. The integration of this technology streamlines question development, ensuring accurate and swift alignment with academic accreditations, thereby saving instructors' time and aiding examiners in certifying program eligibility. The study also explored faculty members' readiness to adopt this technology for evaluating their questions in terms of compliance with ABET outcomes and NCAAA three-level domain zones. A questionnaire administered to faculty members revealed that 100% of respondents endorsed the technology's role in assisting question development, while 11% refused to accept its role in correcting question composition.

A. The Research Objective

The research aims to leverage generative artificial intelligence (AI), particularly ChatGPT, to improve the quality of test questions in an academic setting, aligning with international ABET and local NCAAA accreditations.

B. Research Questions

Is there a method to use generative artificial intelligence to correct instructors' questions to a high-quality level??

Answer:

Yes, by utilizing customized ChatGPT.

C. Methodology

To This study aims to develop and assess the effectiveness of a customized ChatGPT application designed to enhance the quality of questions in educational assessments. The focus is on ensuring that these questions meet the standards required by international and national accreditation bodies, specifically ABET (Accreditation Board for Engineering and Technology) and NCAAA (National Commission for Academic Accreditation & Assessment).

1) *Selection of course and program:* The study was conducted within the Information Systems bachelor's degree program at King Abdulaziz University, a leading institution in the Kingdom of Saudi Arabia. This program is globally recognized with ABET accreditation and is in the process of obtaining national certification from NCAAA. For this study, a course on Web Design was selected as the testing ground due to its relevance to both computing and information systems education.

2) *Development of the ChatGPT application:* To align the questions with accreditation standards, a customized ChatGPT model was developed. The model was tailored to generate and evaluate questions based on the criteria set by ABET and NCAAA. The customization process involved fine-tuning the ChatGPT application to understand and apply the specific requirements of both accreditation bodies.

3) *Criteria for question evaluation:* The evaluation criteria were derived from the Student Outcomes (SOs) defined by ABET and the domains outlined by NCAAA. The focus was on ensuring that the questions generated by instructors are compatible with these criteria, promoting the development of competencies that are essential for program accreditation.

4) *Application of bloom's taxonomy:* To further enhance the quality of the questions, Bloom's Taxonomy was employed as a framework. Bloom's Taxonomy classifies educational learning objectives into levels of complexity and specificity. By mapping the accreditation criteria of ABET and NCAAA onto Bloom's Taxonomy, the study aimed to establish clear links between these criteria and the cognitive levels required by the taxonomy. This approach ensured that the questions not only met accreditation standards but also targeted appropriate levels of cognitive learning.

5) *Testing and validation:* The customized ChatGPT application was tested on the selected Web Design course. The questions generated were evaluated to ensure they met the dual requirements of ABET and NCAAA accreditation. The validation process involved a detailed comparison of the questions against the established criteria, with a particular focus on the alignment with Bloom's Taxonomy.

6) *Data collection and analysis:* The data collected from the application testing was analyzed to assess the effectiveness of the ChatGPT model in generating questions that satisfy both accreditation standards. The analysis also explored the extent to which the use of Bloom's Taxonomy contributed to the improvement of question quality. The study utilizes the links between the two accreditation criteria to provide material

helping ChatGPT evaluate instructors' questions in terms of compatibility with ABET's Student Outcomes (SOs) and the domains outlined by NCAAA [27].

The remainder of this paper is organized as follows:

Section II discusses related works; Section III illustrates the accreditation NCAAA & ABET; Section IV illustrate the Bloom Taxonomy. Section V covers the six students' outcomes of information Systems bachelor Program. Section VI illustrates the mapping Bloom's Taxonomy with NCAAA and ABET. Section VII discusses the design of the proposed custom ChatGPT. Section VIII covers the test of the proposed custom ChatGPT. Section IX covers a questionnaire to assess the acceptance of academic teachers regarding the use of artificial intelligence (AI) and the efficiency of the proposed application. Sections X and XI present the discussion, conclusions and future work, respectively.

II. LITERATURE REVIEW

A. GPT Technology

Number GPT (Generative Pre-trained Transformer) technology is a kind of AI language model created by OpenAI. The main objective of this model is to generate syntactically correct, human-like prose by predicting the next word in a sentence based on contextual information provided by previous words. GPT utilizes deep neural networks to process extensive text data and learn text patterns, enabling the system to generalize contextual and linguistic phrases. As a result, GPT-3, one of the latest versions of GPT, boasts over 175 billion parameters and was trained on a vast volume of internet text data, making it one of the most powerful natural language models available today [9].

B. GPT Technology in Education

There are several ways in which the GPT language model can be used in education [10]:

- GPT technology can be utilized to develop chatbots and virtual language coaches that serve as practice tools for students as they focus on their language skills.
- GPT can serve as a tool for teachers to assist students in improving the quality of their written work.
- GPT can be exploited for grading essays and other types of written assignments without human intervention, saving time and providing students with instant assessment of their progress.
- GPT technology can be applied for students' personalization of interactive learning activities. By analyzing a student's learning processes and preferences, GPT can provide recommendations concerning the type of learning materials that best suit the user, such as articles, videos, and textbooks.

C. ChatGPT

In recent years, Natural Language Processing (NLP) has undergone tremendous development. Nevertheless, the emergence of ChatGPT (Chat Generative Pre-Trained Transformer) has reignited conversations and optimism

surrounding the technology. Developed by OpenAI, ChatGPT was introduced to the public in November 2022 [11]. It quickly gained popularity, reaching over 1 million users in just five days, a stark contrast to Facebook's 300 days, Twitter's 720 days, and Instagram's 75 days [12].

ChatGPT is a large language model with extraordinary comprehension and generation capabilities, closely resembling human speech. Its unparalleled ability to answer questions, engage in conversations, and provide logical and relevant responses within the context of the conversation marks a revolutionary advancement in the development of conversational AI. The diverse applications of ChatGPT and its capacity to enhance across various sectors has brought about new discussions about this cutting-edge AI technology [13]. However, ChatGPT is merely a complicated chatbot at the early stage of Long Short-Term Memory (LSTM) research [14] and cannot be compared to developments in language processing and cognitive sciences. Nevertheless, it is widely used in many industries, including customer service assistance, e-commerce, healthcare, and education. Machine learning, a subfield of AI, enables computers to automatically learn from data, surpassing human-coded instructions. Deep learning has become a powerful predictive tool due to improvements in hardware processing power, data availability, and algorithmic innovations [15], [16], [17], [18]. Furthermore, ChatGPT needs to be fine-tuned for exam purposes as well [19]. ChatGPT is a large language model with remarkable comprehension and speech production capacities akin to those of humans. Its outstanding performance in comprehending questions, dialogue processing, and delivering contextual and coherent responses represents a significant achievement in conversational AI [14]. The first GPT model, GPT-1, was released in 2018, then a successor called GPT-2 in 2019, and later the GPT-3 model in 2020. The model's size, along with the training data and language test scores, have significantly improved since its first version. On November 30, 2022, Open AI released a free behind-the-scenes look at ChatGPT, their AI-powered chatbot expected to be worth \$29 billion [20]. A chatbot is a software system that employs artificial intelligence techniques to converse with humans, simulating human communication. Users pose questions, and the system responds promptly. Within five days of its release, ChatGPT had garnered 1 million users [21].

D. ChatGPT for Exam Correction

The use of ChatGPT for generating and correcting exam questions was studied by Aboalela et al. [22]. The study found that faculty members accepted the use of ChatGPT for both producing and correcting questions. Also, the study by Weng et al. [23] evaluated ChatGPT for Taiwan's Family Medicine Board exams, which included English and Chinese. Despite its popularity and extensive database, ChatGPT's accuracy was found to be 41.6%, indicating limited performance in the medical domain. Notably, it performed better on negative-phrases, mutually exclusive, and case scenario questions. Challenges such as the exam's difficulty level and the shortage of traditional Chinese language resources probably contributed to its lower accuracy. While ChatGPT may be useful for learning and exam preparation, improvements are needed for specialized exams.

E. Benefit of ChatGPT in Education

According to Cribben and Zeinali [24] the benefits of ChatGPT in education are as follows: ChatGPT can generate course materials for professors and produce assignments, test questions, and solutions across different courses. Professors can also utilize ChatGPT to instruct a chatbot to answer students' inquiries over the internet when they are not available during office hours. As an illustration, students have the option to submit their queries to an internet-based discussion platform like eClass or Blackboard, utilizing ChatGPT.

In the same context [25] ChatGPT is an educational accessibility website that assists people with disabilities and non-English speakers by providing spoken responses, topic summarization, and translation services. It enables homework with tailored explanations and examples and builds academic skills. It supports teachers in lesson planning, test generation, grading, analysis, and resource planning in higher education. In addition, ChatGPT personalizes learning adapting to individual styles and performance and assists in exam preparation by reviewing notes, formulating answers, and identifying strengths and weaknesses.

F. Challenges of Using ChatGPT in Higher Education

The obstacles associated with using ChatGPT in higher education, as identified by EU Business School [26], are as follows: ChatGPT's extensive consumption of internet material may lead to unintentional acquisition of preconceived notions and prejudices, potentially resulting in discrimination against various demographic groups. Both students and teachers should acknowledge its inherent subjectivity of it, thoroughly scrutinizing its output for any prejudice.

III. NCAA AND THE ABET

Discussed first is the approach that would be most effective in developing a common application to both organizations. These two accrediting authorities have different purposes. The process of NCAA accreditation process focuses on specialized scientific institutions or academic programs. Certain minimum standards and quality requirements must be met by an institution or program to obtain accreditation from the NCAA. The reputation of an academic institution or its program depends on whether it is accredited or not, as it provides a global reference point for students. Academic excellence, reflected in both local and global reputation, attracts high caliber researchers and practitioners seeking for assurance of quality education. Accreditation aims to ensure that the outputs of educational institutions and academic programs meet societal needs; it also seeks to foster cooperation between the education system and the professional labor market [28]. This fosters trust and belief in academic programs among the community and helps them attain a stable financial standing.

The NCAA grants accreditation to the university, as well as to each individual program offered by the institution. The NCAA accredits both the university as a whole and each individual program it offers. On the other hand, ABET serves as a quality assurance mechanism specifically for programs in applied and natural sciences, computer science, engineering, and engineering technology [5] ABET accreditation is globally recognized for ensuring that college or university programs meet

the quality standards of the profession they prepare graduates for. One distinction between ABET and the NCAAA lies in their accreditation focus: while the NCAAA accredits entire universities, ABET accredits specific programs [29]. Another difference is that ABET prioritizes the attainment of student learning objectives over the instruction of methodologies and course standards. However, both agencies evaluate educational procedures within academic programs and investigate similar topics related to quality assurance, including program objectives, course learning outcomes, and individual student learning outcomes. Program Learning Outcomes (PLOs) are measurable statements that describe the knowledge or skills students acquire upon completing an academic program, while Course Learning Outcomes (CLOs) are specific statements that define the knowledge, skills, and attitudes learners will demonstrate upon completing a particular course. Assessing students' learning outcomes involves formulating questions using action verbs to measure their proficiency and understanding of the subject matter. Subsequently, students' comprehension is evaluated based on the grades they achieve for questions related to specific areas of knowledge or ability. Saudi institutions have the potential to obtain both national and international accreditation for academic programs, allowing them to pursue multiple accreditation approaches. Several research studies have suggested a potential connection between ABET and the NCAAA in the Kingdom of Saudi Arabia, with published evidence supporting these potential outcomes [30] [31].

IV. BLOOM'S TAXONOMY

The importance of Bloom's Taxonomy in assessing knowledge [32] [33] [34] lies in its capacity to correlate specific verbs with the educational outcomes required for both ABET and NCAAA accreditation. This facilitates the use of standardized verbs in questions that meet the criteria of both accrediting bodies. Thus, when employing commonly used question verbs to evaluate the same educational outcomes, alignment with both ABET and NCAAA standards is ensured. The subsequent task involves categorizing the verbs used according to the areas required for NCAAA accreditation measurement. Bloom's Taxonomy functions to classify verbs assessing skills and comprehension into six distinct categories, as depicted in Fig. 1. These six domains of Bloom's Taxonomy have been further delineated to encompass areas specific to NCAAA accreditation. The top five domains, which are the most intricate, include the NCAAA domain of skills, covering processes such as application, assessment, evaluation, and production. The lowest and most intricate domain, understanding, remains a specialized area within the NCAAA domain. Verbs were categorized according to Bloom's Taxonomy, as illustrated in the figure depicting the mapping. Once the correlation between taxonomy verbs and NCAAA measure verbs that evaluate skills is established, they can be identified based on either the prescribed verbs for ABET certification or the NCAAA accreditation criteria.

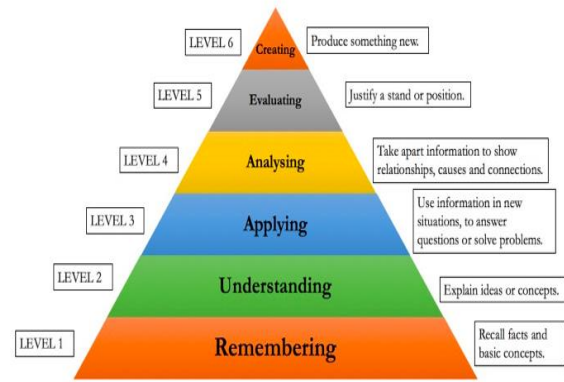


Fig. 1. The Bloom taxonomy verbs [40].

V. ABET SIX STUDENTS' OUTCOMES OF INFORMATION SYSTEM BACHELOR PROGRAM

The mapping of Bloom's Taxonomy to ABET is as follows:

SO 1 corresponds to the third-level verb in Bloom's Taxonomy:

Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.

SO 2 corresponds to levels 6, 5 and 4 based on the SO subpoint and the action verb in Bloom's Taxonomy: Communicate effectively in a variety of professional contexts.

SO 3 corresponds to special verb in Bloom's Taxonomy based on the target of the asked question and to the value domain of NCAAA:

Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.

SO 4 corresponds to a special verb in Bloom's Taxonomy based on the target of the asked question and to the value domain verb in NCAAA:

Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.

SO 5 corresponds to a special verb in Bloom's Taxonomy based on the target of the asked question and to the value domain verb in NCAAA (Affective Learning):

Support the delivery, use, and management of information systems within an information systems environment.

SO 6 corresponds to the lower level (Understanding) of Bloom's Taxonomy based on the target of the asked question and to the SKILL domain verb in NCAAA. For each SO, there are special verbs for the one director who must ask the question. To find a method to connect the verbs of each ABET's SO with the NCAAA's domains, the six ABET outcomes were divided into the six Bloom's Taxonomy domains, which were then divided into the three NCAAA domains taxonomy.

VI. MAPPING BLOOM’S TAXONOMY WITH ABET AND NCAAA

Fig. 2 shows the mapping between Bloom’s Taxonomy & NCAAA. Table I summarizes the mapping between the accreditations ABET & NCAAA and Bloom’s Taxonomy.

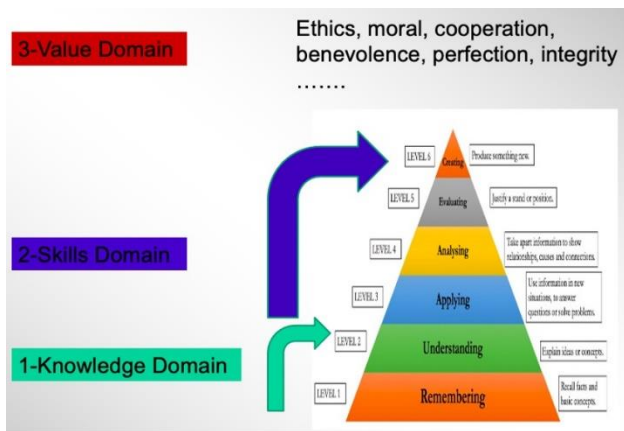


Fig. 2. Mapping Bloom’s taxonomy to NCAAA three domains.

TABLE I. THE MAPPING BETWEEN THE ACCREDITATIONS AND THE BLOOM’S TAXONOMY. [22]

ABET SO	NCAAA Domains	Bloom’s Taxonomy Level
SO1	Skills domain	L3, L5, L6
SO2	Skills domain	L5, L6
SO3	Value domain	L2, L3
SO4	Value domain	L2, L3
SO5	Value domain	L2, L3
SO6	Skills domain	L2, L3

Correlating the Verb Used in a Question to the ABET and Bloom’s Taxonomy. ABET specializes in specific verbs to request information about each subject object. This tool facilitates the creation of questions that align with accreditations. The NCAAA mandates the use of specific verbs. The utilization of these verbs is essential for the automated production and verification of questions utilizing ChatGPT technology. ChatGPT technology is user-friendly when the computer is supplied and educated via generative AI. These identical verbs might be utilized to generate inquiries pertaining to NCAAA. They collectively fulfilling the criteria of both ABET and NCAAA. Therefore, if the academic program receives two distinct accreditations, the questions developed will be suitable for both accreditations. Here are some instances of these verbs. Table II displays the question verb that ABET has designated to assess each Student Outcome (SO). The table also displays the verb mapped to the Bloom's Taxonomy. The question verbs are expected to be the same for both ABET and NCAAA [22].

Whereas the subpoints 1.1, 1.2, 2.1, 2.2, 2.3, 3.1-3.3, 4.1-4.3, 5.1, 5.2-5.3, 6.1, 6.2 and 6.3 are subpoints of the major 6 SO and they measure the following SO.

1.1: An ability to analyze a complex computing problem. (Analyzing).

1.2: An ability to apply principles of computing and other relevant disciplines to identify solutions. (Applying).

2.1 An ability to design a computer-based system, process, component, or program to meet desired needs.

2.2: An ability to implement a computer-based system, process, component, or program to meet desired needs.

2.3: An ability to evaluate a computer-based system, process, component, or program to meet desired needs.

3.1: An ability to conduct an oral presentation using effective communication skills. (Applying).

3.2: An ability to write in a clear, concise, grammatically correct and organized manner. (Applying).

3.3: An ability to develop appropriate illustrations including hand sketches, computer generated drawings/graphs and pictures. (Applying).

TABLE II. QUESTION VERBS MAPPED TO NCAAA AND ABET SO

The question verb	The Bloom’s Taxonomy VERB LEVEL	The ABET SO number
Appraise, assess, evaluate, compare, contrast, criticize, differentiate, discriminate, distinguish, examine, experiment, question, test	[Analyzing]	1.1
Choose, demonstrate, employ, illustrate, interpret, operate, schedule, sketch, draw, solve, use, write.	[Applying]	1.2
An ability to design a computer-based system, process, component, or program to meet desired needs.	[Creating]	2.1
An ability to implement a computer-based system, process, component, or program to meet desired needs.	[Applying]	2.2
An ability to evaluate a computer-based system, process, component, or program to meet desired needs.	[Evaluating]	2.3
Choose, demonstrate, employ, illustrate, interpret, operate, schedule, sketch, draw, solve, use, write.	[Applying]	3.1-3.3
Classify, describe, discuss, explain, identify, locate, recognize, report, select, translate, paraphrase	[Understanding]	4.1-4.3
Choose, demonstrate, employ, illustrate, interpret, operate, schedule, sketch, draw, solve, use, write.	[Applying]	5.1
[Affective Learning] Appreciate, accept, attempt, challenge, defend, dispute, join, judge, justify, question, share, support	Any verb level which should be determined by the SO of the topic.	5.2-5.3
Appraise, assess, evaluate, compare, contrast, criticize, differentiate, discriminate, distinguish, examine, experiment, question, test	[Analyzing]	6.1
Choose, demonstrate, employ, illustrate, interpret, operate, schedule, sketch, draw, solve, use, write.	[Applying]	6.2
Classify, describe, discuss, explain, identify, locate, recognize, report, select, translate, paraphrase.	[Understanding]	6.3

4.1: Understanding of professional responsibilities, ethical theories, legal and social issues. (Understanding).

4.2: Understanding of cyber security threats and corresponding procedures to mitigate these threats. (Understanding).

4.3: Understanding of risk management, security policies and audit procedures. (Understanding).

5.1: An ability to prepare a work schedule for the assigned task and complete it within the appropriate deadlines. (Applying).

5.2: An ability to participate in team meetings with full preparedness for providing useful input. (Affective Learning).

5.3: An ability to share ideas among the team and promote good communication among the team members. (Affective Learning).

6.1 Support the delivery of information systems within an information Systems environments.

6.2 Support the use of information system within an information Systems environments.

6.3 Support the management of Information Systems within an information Systems environments.

Studying the extent to which faculty members accept the use of ChatGPT technology. In order to produce student assessment questions and tests. These subpoints are extracted from ABET official documents from IS department of FCIT of King Abdulaziz University [35].

VII. DESIGN A CUSTOM CHATGPT

Proficiency in programming is essential for developing a customized ChatGPT application. However, beneficiaries may find platforms offering pre-made tools for design applications. Typically, the beneficiary must ascertain three fundamental aspects:

- The application's objective.
- Enumerate the characteristics of it.
- Selecting the platform, whether it is a mobile or web-based chat application.

To integrate GPT, the user must determine the appropriate version of GPT to utilize, such as GPT-3.5, developed by OpenAI. The designer requires an API key, which can be obtained by accessing the OpenAI platform. They can use either the library or the requests module in their chosen programming language, such as Python. In this research paper, the OpenAI platform is employed to correct questions based on accreditation requirements. Two accreditations were examined: ABET and NCAAA. The implementation test focused on the course COIS 492, which is part of the fifth level of the Information Systems Department in the bachelor's degree program at the Faculty of Computing Science & Information Technology, King Abdulaziz University, Rabigh Branch. The course adheres to ABET accreditation requirements for measuring Student Learning Outcomes (SLOs) and aims to fulfill NCAAA requirements, as national NCAAA accreditation is mandated by the Ministry of

Education of Saudi Arabia [36]. The questions in the course assessments must meet ABET standards. In this research, the implementation of the ChatGPT application ensured that both NCAAA and ABET requirements were met before approving a question generated by the application. Several researchers in Saudi Arabia have studied the alignment of ABET [37] and NCAAA [38] [39] accreditation requirements as a unified and mutually satisfactory solution.

In the proposed ChatGPT application, the most crucial condition involves using the correct question verb for a specific Student Outcome within the appropriate domain. The course COIS 492 focuses on SO 2, 4, and 6. Table II illustrates the question verbs mapped to NCAAA and ABET SOs. The content of this table was integrated into the ChatGPT application to ensure the accuracy of the questions. The application's role is to verify the correctness of questions posed by the instructor for a specific SO. If the question is correct, it is approved. ChatGPT was specifically developed to test questions submitted by faculty members, ensuring their adherence to accreditation requirements such as ABET and NCAAA. The application is equipped with two files: an SO file and a relationship table between NCAAA and ABET. The application has been named "QUESTION CHECKER," as depicted in Fig. 3, which illustrates the app interface.

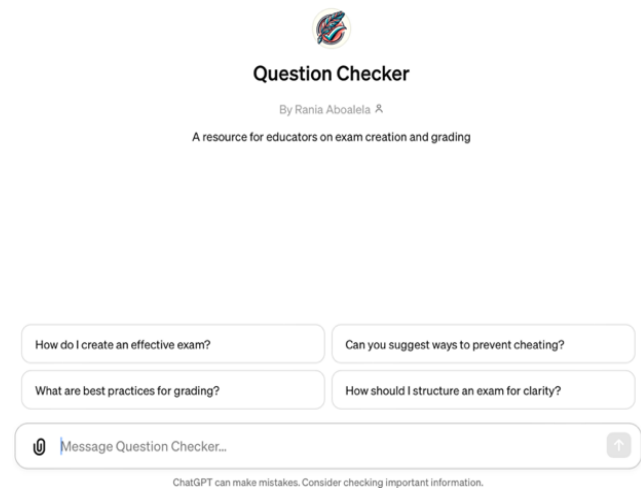


Fig. 3. Question checker application interface.

A. Role and Goal

This GPT serves as an advanced question checker, specifically designed for educators setting short answer and essay questions. It verifies questions for correctness based on the relation between the question's verbs and the intended student outcomes. It also offers suggestions for improving question clarity and alignment with educational goals.

B. Constraints

The checker provides feedback on question grammar, recommends more suitable verbs based on a table of verb relationships and student outcomes, and provides constructive feedback to refine questions. It proactively suggests improvements and awaits explicit queries before offering feedback, aiming to enhance the clarity and educational value of questions.

VIII. THE APPLICATION TEST

The application's ability to correct questions provided by instructors to align with ABET and NCAAA accreditation requirements has been tested. This includes verifying the accuracy of the question's action verb to test the appropriate Student Outcome (SO) and the relevant domain intended for assessment by the question. The application was used to test the accuracy of a diverse set of questions, identifying both incorrect and correct questions. The application was tested for two purposes: assisting in creating accurate questions and correcting erroneous questions while providing comments and suggestions.

A. To Assist in Creating Accurate Questions

After providing the application with the accreditation criteria in terms of verbs and scope, the application explained how to formulate questions as a guide for faculty members. The application provides users with steps to write correct questions as showing in the output of the application which is illustrated in Fig. 4. Fig. 4 shows Question Checker Q. C. explaining how to create appropriate questions that meet NCAAA & ABET criteria. This explanation can be edited by developers.

B. To Validate and Correct the Questions

Faculty members can seek evaluation of their questions using any method they find suitable. A set of questions from various topics and courses was input into the Question Checker App to assess its efficiency. For this paper, a subset of questions was selected from the Web Design & Development course, with each question targeting a specific Student Outcome (SO). The course has three basic ABET Student Outcomes: 1, 2, and 6. The application's responses were as follows:

Questions 1 through 8 were entered into the app to validate test questions targeting Student Outcomes SO: 1.1, SO: 1.2, SO: 2.1, SO: 2.2, SO: 2.3, SO: 6.2, SO: 6.1, and SO: 6.3, respectively. Fig. 5, 6, 7, 8, 9, 10, 11, and 12 show the instructor's questions and the responses of the Question Checker app. These questions were introduced to test the efficiency of the QC application in evaluating the eight student outcomes. The first question was: Q1. "Differentiate among the validators: Range validator and Regular Expression validator in terms of purpose, syntax, and an example."

The QC application validates questions, provides reasons for validation, and offers enhancement suggestions. The question and the app's response are illustrated in Fig. 5. As shown in Fig. 5, the ABET and NCAAA domains were used to evaluate the question. The QC app can either validate or invalidate a question and suggest updates for both cases. For example, consider question Q2: "Use ASP.NET to create a master page including title, dynamic navigation, and copyright." The QC application provided suggestions to improve the question without giving explicit validation responses. Fig. 6(a) shows the instructor's question and the QC application's response with suggestions. The app validated the question but suggested enhancements to clarify it. Fig. 6(b) displays the validation of the revised question.

Question Checker

Crafting questions that align with the National Commission for Academic Accreditation and Assessment (NCAAA) and the Accreditation Board for Engineering and Technology (ABET) standards involves understanding the specified student outcomes and matching them with the appropriate level of cognitive demand as outlined in Bloom's Taxonomy. Here are the steps to follow:

- 1. Understand Student Outcomes (SOs):** Begin by reviewing the specific student outcomes outlined by NCAAA and ABET for your program. These outcomes describe what students should be able to do by the end of the program and are categorized into different domains such as applying knowledge, designing systems, ethical reasoning, communication skills, teamwork, and understanding professional responsibility.
- 2. Review Bloom's Taxonomy Levels:** Familiarize yourself with Bloom's Taxonomy levels—Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating. Each level represents a different type of cognitive demand, from basic recall of information to complex analysis and creative problem-solving.
- 3. Match SOs with Bloom's Levels:** Align each student outcome with the appropriate level(s) of Bloom's Taxonomy. This alignment ensures that the questions you craft will target the cognitive skills necessary to achieve the intended learning outcomes. For example, an outcome related to designing a system may align with the Creating level, while understanding professional responsibility might align with the Understanding level.
- 4. Select Appropriate Verbs:** Use the mapped verbs from the provided tables to guide your question construction. Each Bloom's level is associated with specific action verbs that help in formulating questions. For instance, to assess Analyzing outcomes, you might use verbs like compare, contrast, or evaluate. For Applying outcomes, verbs like demonstrate, solve, or use could be appropriate.
- 5. Craft Questions:** With the outcomes, Bloom's levels, and verbs in mind, start crafting your questions. Ensure that each question is clearly worded, unambiguous, and specifically designed to assess the intended student outcome. For example, to assess the ability to analyze a problem (SO 1.1), a question might start with "Evaluate the following scenario to identify potential computing solutions..."
- 6. Review and Refine:** After drafting your questions, review them to ensure they align with both the student outcomes and the cognitive level intended. Make sure the questions are challenging yet fair, and that they truly measure the students' understanding and skills in relation to the program's learning outcomes.
- 7. Feedback and Iteration:** If possible, seek feedback from colleagues on the clarity and alignment of your questions. Use this feedback to refine your questions further. This iterative process helps in enhancing the quality and effectiveness of your assessment items.
- 8. Integration into Assessments:** Once refined, integrate these questions into your quizzes, exams, or other assessment tools. Ensure that your assessments as a whole cover a broad range of the program's student outcomes and adequately reflect the diverse cognitive skills outlined in Bloom's Taxonomy.

By following these steps, you'll be able to create well-aligned, clear, and effective questions that not only meet NCAAA and ABET standards but also foster deep learning and critical thinking among your students.



Fig. 4. Question checker guideline for creating a correct question.

You

Q2.

Use ASP.NET app to create master page including title, navigation, copyright
Is this valid question to test SO:1.2

Question Checker

Given the objective of SO 1.2, which is to "Apply principles of computing and other relevant disciplines to identify solutions," your question about using an ASP.NET application to create a master page including a title, navigation, and copyright is indeed valid. This task aligns with the action verbs listed under SO 1.2, such as "choose," "demonstrate," "employ," "illustrate," "interpret," "operate," "schedule," "sketch," "draw," "solve," "use," and "write." These verbs emphasize the application of knowledge and skills in practical settings.

The question directs students to apply their knowledge of ASP.NET (a specific computing technology) to create a functional component of a web application (the master page), which is a direct application of computing principles. It requires them to use their skills in a practical task, demonstrating their ability to implement a solution based on specified requirements.

To further align with SO 1.2 and enhance the question, you might consider specifying more details about the functionality or design requirements of the master page, thereby encouraging students to employ a broader range of computing principles and disciplines in their solution. Additionally, asking students to justify their design choices or to describe how their implementation meets the needs of a hypothetical user scenario could deepen their application of computing principles, thus reinforcing the connection to SO 1.2.

Fig. 5. The Validation of question 1 testing SO 1.1.

You
Q2. Update
Use ASP.NET app to create CUSTOM master page including title, dynamic navigation, copyright
Is this valid question to test SO:1.2

Question Checker
The revised question, "Use ASP.NET app to create CUSTOM master page including title, dynamic navigation, copyright," remains a valid and effective way to assess Student Outcome (SO) 1.2. SO 1.2 is focused on the application of computing principles and other relevant disciplines to identify solutions. The task of creating a custom master page with specified features like a title, dynamic navigation, and copyright elements using ASP.NET directly engages students in applying their knowledge of web development practices and principles to solve a practical problem.

The inclusion of "dynamic navigation" in your updated question adds a layer of complexity and practical application that is very suitable for testing SO 1.2. This addition requires students not only to use their knowledge of ASP.NET but also to incorporate principles of user interface design and possibly information architecture, which are essential disciplines within computing.

To further align with the "Applying" level of Bloom's Taxonomy, which underpins SO 1.2, it's crucial that the question prompts students to demonstrate their ability to employ their knowledge in a real-world scenario. Creating a master page with these components requires students to interpret requirements, choose appropriate tools and techniques, and ultimately employ their skills in a practical task—actions that are at the heart of the "Applying" category in Bloom's Taxonomy.

To improve the question further and ensure it effectively measures SO 1.2, you might consider specifying additional requirements or context for the master page creation. For example, indicating the intended use of the master page or the audience can help students understand the practical implications of their design choices, making the task more aligned with real-world application. This specification could also assist in evaluating the students' ability to apply computing principles more comprehensively, as they would need to consider usability, accessibility, and responsiveness in their designs.

In summary, your updated question is well-suited for assessing SO 1.2. It requires the application of computing principles to a practical task, which is directly aligned with the intended learning outcome. Adding further detail or context could enhance its effectiveness by ensuring that students apply their knowledge in a way that mirrors professional practice.

🔊 📄 🔄 🗑️

(a)

You
Q2. Update
Use ASP.NET app to create CUSTOM master page including title, dynamic navigation, copyright
Is this valid question to test SO:1.2

Question Checker
The revised question, "Use ASP.NET app to create CUSTOM master page including title, dynamic navigation, copyright," remains a valid and effective way to assess Student Outcome (SO) 1.2. SO 1.2 is focused on the application of computing principles and other relevant disciplines to identify solutions. The task of creating a custom master page with specified features like a title, dynamic navigation, and copyright elements using ASP.NET directly engages students in applying their knowledge of web development practices and principles to solve a practical problem.

The inclusion of "dynamic navigation" in your updated question adds a layer of complexity and practical application that is very suitable for testing SO 1.2. This addition requires students not only to use their knowledge of ASP.NET but also to incorporate principles of user interface design and possibly information architecture, which are essential disciplines within computing.

To further align with the "Applying" level of Bloom's Taxonomy, which underpins SO 1.2, it's crucial that the question prompts students to demonstrate their ability to employ their knowledge in a real-world scenario. Creating a master page with these components requires students to interpret requirements, choose appropriate tools and techniques, and ultimately employ their skills in a practical task—actions that are at the heart of the "Applying" category in Bloom's Taxonomy.

To improve the question further and ensure it effectively measures SO 1.2, you might consider specifying additional requirements or context for the master page creation. For example, indicating the intended use of the master page or the audience can help students understand the practical implications of their design choices, making the task more aligned with real-world application. This specification could also assist in evaluating the students' ability to apply computing principles more comprehensively, as they would need to consider usability, accessibility, and responsiveness in their designs.

In summary, your updated question is well-suited for assessing SO 1.2. It requires the application of computing principles to a practical task, which is directly aligned with the intended learning outcome. Adding further detail or context could enhance its effectiveness by ensuring that students apply their knowledge in a way that mirrors professional practice.

🔊 📄 🔄 🗑️

(b)

Fig. 6. (a) Suggestion of enhancement question 2 testing SO 1.2. (b) The Validation of revised question 2 to test SO: 1.2.

Another example is question Q4: "Write the correct syntax" for testing SO 2.2. The QC application provided suggestions to improve the question without explicit validation responses. Fig. 8(a) shows the instructor's question and the QC application's response with suggestions. The app validated the question but suggested enhancements for clarity. The instructor implemented the QC suggestions and updated the question. Fig. 8(b) shows the updated question and the app's response.

Question 3 explicitly asked about SO: 2.1. The QC application validated the question and offered suggestions for enhancement. Fig. 7 shows the question and the app's response. Q4 tests the efficiency of the application in validating SO: 2.2. The application suggested adding more information to better target SO: 2.2. Fig. 8(a) shows the question and the QC application's response, while Fig. 8(b) displays the validation of the revised question as per the application's suggestions.

Fig. 9 shows the validation of question Q5, which tests SO: 2.3. As illustrated in Fig. 11, the question targets SO: 6.1, and the QC application directly validated it. Question Q8 tests the target SO: 6.3, and the validation with the application is shown in Fig. 12. Question Q6 was identified as invalid and will be discussed later. A summary of the introduced questions and the application responses is provided in Table III.

You
Q3. Design a web page layout using HTML and CSS that addresses specific user needs or preferences!
User
Is this question valid to ask about SO 2.1

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Question Checker
Yes, the question "Design a web page layout using HTML and CSS that addresses specific user needs or preferences" is valid and well-aligned with Student Outcome (SO) 2.1. SO 2.1 is described as an ability to design a computer-based system, process, component, or program to meet desired needs, and falls under the [Creating] level of Bloom's Taxonomy.

This question effectively targets the [Creating] level by asking students to engage in a design process that requires them to consider user needs and preferences, and then to implement a solution through the creation of a web page layout using HTML and CSS. It encompasses the following aspects that align with SO 2.1:

- **Design Thinking:** Students must conceptualize a web page layout that is not only functional but also tailored to meet specific user needs or preferences, demonstrating an understanding of user-centered design principles.
- **Technical Skills Application:** By using HTML and CSS, students apply technical skills in a practical context, which is essential for the creation of computer-based solutions.
- **Creativity and Innovation:** The requirement to address specific user needs encourages students to think creatively and innovatively to come up with design solutions that are both effective and unique.

To enhance the question further and ensure a comprehensive assessment of SO 2.1, consider specifying certain constraints or requirements for the web page design. This could include considerations for accessibility, responsiveness, or the inclusion of specific elements (like forms or multimedia content) that might be relevant to the user needs or preferences identified. This approach would not only challenge students to apply their technical knowledge in a more targeted way but also to think critically about how design choices impact user experience and system functionality.

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Fig. 7. Validation of question 3 to test SO 2.1.

You
Q4. Write the correct Syntax
is this question valid to test SO:2.2 ?

Question Checker
The question "Write the correct Syntax" in its current form is very broad and lacks specificity, which makes it challenging to directly assess its alignment with Student Outcome (SO) 2.2. As per the documentation, SO 2.2 is about the ability to implement a computer-based system, process, component, or program to meet desired needs, focusing on the application of computing principles in a practical context.

For a question to effectively target SO 2.2, it should encapsulate a scenario or context that requires students to apply their knowledge and skills in implementing a computing solution. The verb "write" falls under the "Applying" category of Bloom's Taxonomy, which is consistent with SO 2.2. However, the term "correct Syntax" is too vague because it does not specify what language or technology students are being asked to use, nor does it describe the problem they need to solve or the context in which their skills are being applied.

To improve the question and make it a valid tool for assessing SO 2.2, consider incorporating the following elements:

1.

Specify the Programming Language or Technology: Clearly indicate whether the syntax pertains to a specific programming language (e.g., JavaScript, Python, C++) or technology (e.g., SQL, HTML/CSS). This specificity is crucial because syntax varies significantly across different languages and technologies.

2.

Provide a Context or Scenario: Offer a scenario or problem that the syntax will address. This could involve asking students to write syntax that accomplishes a particular task (e.g., querying a database, rendering a web page element, or processing user input). The context should reflect a real-world application to demonstrate the practical implementation of computing principles.

3.

Outline Desired Outcomes or Requirements: Clearly define what the implemented solution must achieve. This could include specific functionalities, performance criteria, or user interaction outcomes. These details help students understand the scope of the problem and align their solutions with the defined requirements.

4.

Encourage Problem-Solving and Creativity: Pose the question in a way that encourages students to think critically about how their solution meets the desired needs. This approach assesses not only their technical skills but also their ability to apply those skills creatively and effectively in problem-solving.

In summary, while the intent behind the question "Write the correct Syntax" could be relevant to SO 2.2, its effectiveness as a measure of students' ability to implement computing solutions is limited without further details and context. By specifying the language or technology, providing a clear scenario, and outlining desired outcomes, the question can be refined to more accurately assess students' skills in implementing computer-based systems, thus aligning it more closely with SO 2.2.

(a)

You
Q4 UPDATE
Q4. Write the correct syntax to display the following output in the browser by using JAVA script code
Is this valid question to ask about SO:2.2

Question Checker
The updated question, "Write the correct syntax to display the following output in the browser by using JavaScript code," focuses on the application of JavaScript programming to achieve a specific outcome within a web browser. This question is intended to assess students' ability to apply their knowledge of JavaScript to manipulate or produce content dynamically in a web environment.

Given that SO 2.2 involves the ability to implement a computer-based system, process, component, or program to meet desired needs, this question does align with SO 2.2 under the "Applying" category of Bloom's Taxonomy. Implementing functional JavaScript code to achieve a specified output in a web browser is a practical application of programming skills and directly involves the process of implementing a component of a computer-based system (in this case, a web application or website).

However, to enhance the alignment of this question with SO 2.2 and ensure it effectively assesses the intended outcome, consider the following aspects:

1.

Specify the Output: Clarify what the "following output" refers to. Providing a clear, detailed description of the expected output or behavior in the browser will help students understand the requirements and the context in which their JavaScript code must operate. This detail is crucial for assessing their ability to implement a solution that meets specific needs.

2.

Contextualize the Task: To strengthen the connection to implementing a computer-based system or component, it may be helpful to frame the JavaScript coding task within a broader application context. For example, describe a scenario where the JavaScript functionality plays a crucial role in the user experience or functionality of a web application. This approach emphasizes the relevance of the task to real-world web development and system implementation.

3.

Encourage Problem-Solving: Ensure that the question not only tests students' ability to write syntactically correct JavaScript but also encourages them to think about how their code fits into a larger system or meets user needs. This could involve asking students to consider how their code enhances the functionality or usability of a webpage, aligning with the goal of implementing solutions that meet desired needs.

In summary, your updated question is suitable for assessing SO 2.2, as it requires students to apply JavaScript coding skills in a practical context. To maximize its effectiveness, ensure the task is clearly defined and placed within a broader context that underscores the importance of implementation skills in meeting specific requirements or solving real-world problems. This approach will not only align with the educational goal of SO 2.2 but also prepare students for the practical challenges they will face in their careers.

(b)

Fig. 8. (a) Suggestion of enhancement for question 4 to test SO 2.2. (b) The Validation of Revised question 4 to test SO: 2.


TABLE III. SUMMARY OF THE QC APPLICATION RESPONSES TO VALIDATE THE INTRODUCED QUESTIONS

THE QUESTION #	THE TARGET SO	TYPE OF QUESTION TO TEST SO	QC VALIDATION	IMPROVEMENT SUGGESTION	THE UPDATED Q	THE VALIDATION OF REVISED QUESTION	FIGURE #
question 1	1.1	Explicit	YES	NA	NA	NA	5
question 2	1.2	Explicit	YES	YES	YES	Yes	6
question 3	2.1	Explicit	YES	NA	NA	NA	7-1
question 4	2.2	Explicit	YES	Yes	YES	Yes	8-1, 8-2 update
question 5	2.3	Explicit	Yes	Yes	NA	NA	9
question 6	6.2	Explicit	NO	YES	YES	YES	10-1, 10-2
question 7	6.1	Explicit	YES	YES	NA	YES	11
question 8	6.3	Explicit	YES	NA	NA	NA	12
question 9	2.2	Implicit	NA	NA	NA	NA	13

C. Examples of Question Checker Evaluation to Invalid Questions and Enhancement

Question Q6 was selected to test the application's efficiency in identifying invalid questions. Fig. 10(a) and (b) depict the evaluation of the Question Checker app for questions related to SO 6.2. The original question, Q6, asked for the four methods of a command class, with the instructor seeking validation that it targeted SO 6.2. However, the app's QC deemed the question invalid for testing SO 6.2, providing reasons and suggestions for improvement. Consequently, the question was revised based on the QC's suggestions, resulting in an updated question: Q6: "Explain how the Command class can be used to support information systems within specific environments."

You
Q5. Justify that the ASP.NET supports safe for websites
Is this question valid to ask about SO: 2.3??

 **Question Checker**
The question "Justify that ASP.NET supports safety for websites" is aimed at assessing students' ability to evaluate a computing-based solution, in this case, ASP.NET's safety features for websites. This aligns with the essence of Student Outcome (SO) 2.3, which is focused on the ability to evaluate a computer-based system, process, component, or program to meet desired needs, particularly from the perspective of evaluating for certain qualities such as safety.

SO 2.3 falls under the "Evaluating" category of Bloom's Taxonomy, which involves making judgments based on criteria and standards. The task of justifying the safety features of ASP.NET requires students to critically assess the framework's security mechanisms, how they are implemented, and their effectiveness in ensuring website safety. This requires not only an understanding of ASP.NET's features but also an ability to critically evaluate these features against security needs and standards.

However, to ensure that the question effectively targets SO 2.3, consider the following enhancements:

- 1.

Specify Criteria for Safety: To guide students in their evaluation, it may be beneficial to specify what aspects of safety they should focus on. This could include aspects such as data protection, authentication mechanisms, protection against common vulnerabilities (e.g., SQL injection, cross-site scripting), and so on. Providing criteria will help students understand what aspects of ASP.NET they should be evaluating and what standards or best practices they should use as a basis for their justification.

- 2.

Encourage Use of Evidence and Examples: Prompt students to support their justifications with evidence or examples. This could include referencing specific ASP.NET features, mechanisms, or practices and discussing how these contribute to website safety. Encouraging the use of evidence will make the evaluation more rigorous and grounded in concrete analysis.

- 3.

Ask for a Comparative Analysis: To deepen the evaluation, you might ask students to compare ASP.NET's safety features with those of another web development framework. This comparison can provide a more nuanced understanding of ASP.NET's strengths and weaknesses in terms of safety and encourages students to apply evaluative thinking not just in isolation but in comparison with alternative solutions.

In summary, the question is valid for assessing SO 2.3, as it requires students to evaluate ASP.NET in terms of its ability to support safety for websites. By specifying criteria for evaluation, encouraging the use of evidence, and possibly including a comparative analysis, you can enhance the question's effectiveness in measuring students' evaluative skills in the context of computing solutions.





Fig. 9. The Validation of question 5 to test SO: 2.3

The QC suggested adjusting the question to include how these methods contribute to the support and improvement of information systems, which would make it more valid and relevant for assessing SO 6.2. Fig. 10(b) shows the validation of the revised question.

You
Q6. WRITE FOUR METHODS OF COMMAND CLASS
IS THIS QUESTION VALID TO ASK ABOUT SO 6.2 ?

 **Question Checker**
Student Outcome (SO) 6.2 is centered on supporting the use of information systems within an information systems environment. This outcome emphasizes practical understanding and the application of knowledge to enhance the functionality, efficiency, and user experience of information systems.


The question "Write four methods of the Command class" aims at assessing knowledge related to a specific programming concept, presumably within the context of information systems. The Command pattern is a behavioral design pattern that turns a request into a stand-alone object that contains all information about the request. This separation allows for parameterizing methods with different requests, delaying or queuing a request's execution, and supporting undoable operations.

Considering SO 6.2's focus, this question could be seen as partially aligned because it assesses technical knowledge that could underpin the development or enhancement of information systems, particularly in relation to software design and architecture. Understanding and being able to articulate methods of the Command class might contribute to students' ability to support and improve information system functionalities through software development practices.

However, the direct relevance of this question to SO 6.2 may depend on several factors:


- **Contextual Relevance:** If the curriculum or learning outcomes specifically include software design patterns as a critical component of supporting information systems, this question would be more directly relevant.
- **Application Focus:** SO 6.2 seems to emphasize the practical application and support of information systems. A question that not only asks for methods but also how they are applied can be used to support information systems might align more closely with SO 6.2.
- **Integration with Information Systems:** It would strengthen the question's relevance if it included a prompt for students to explain how these methods support or enhance the use of information systems, tying back directly to the goal of SO 6.2.

In summary, while the question touches on knowledge relevant to software development—a component of information systems—the direct alignment with SO 6.2 would be enhanced by explicitly connecting the technical knowledge assessed (i.e., Command class methods) with the broader goal of supporting the use and functionality of information systems. Adjusting the question to include how these methods contribute to the support and improvement of information systems would make it more valid and relevant for assessing SO 6.2.




(a)

You
Update
Q6. Write how the command class of ASP.NET can be used to support information systems within specific environment.
Is this question valid to test SO:6.2 ?

 **Question Checker**
Yes, the question "Write how the Command class of ASP.NET can be used to support information systems within a specific environment" is a valid approach to assess Student Outcome (SO) 6.2, which concerns the support of the use of information systems within Information Systems environments. This question aligns with the "Applying" category of Bloom's Taxonomy, which is associated with SO 6.2, because it asks students to apply their knowledge and skills to a specific, practical context.

The question targets the application of a technical solution (the Command class in ASP.NET) to support operational aspects of information systems, which is at the core of SO 6.2. The inclusion of "write" as the action verb encourages students to convey their understanding and application skills in written form, which matches the verbs related to SO 6.2 like "choose," "demonstrate," "employ," "illustrate," "interpret," "operate," "schedule," "sketch," "draw," "solve," "use," and "write."

To ensure the question effectively measures students' abilities as intended under SO 6.2, it might be useful to provide additional guidance or context about what "specific environment" refers to. This could include specifying the type of information systems or the operational challenges within those environments that the Command class could address. By doing so, the question not only becomes more precise in its aim but also helps students focus their answers more directly on demonstrating their capability to apply ASP.NET tools in supporting information systems, thereby aligning with the educational goals of SO 6.2.



(b)

Fig. 10. (a) The Suggestion enhancement of Q6 to test SO 6.2. (b) 2- The Validation of Q6 to test SO 6.2 after considering the Question Checker application enhancement suggestion.

You
Q7. Evaluate the use of ASP.NET to manage large websites?
Is this question valid to ask about SO:6.1?

Question Checker
Yes, the question "Evaluate the use of ASP.NET to manage large websites?" is valid for assessing Student Outcome (SO) 6.1, which focuses on supporting the delivery of information systems within an information systems environment. The verb "evaluate" aligns well with the "Analyzing" level of Bloom's taxonomy, appropriate for SO 6.1. This question encourages a critical analysis of ASP.NET's capabilities in managing large websites, directly relevant to the student outcome.

Fig. 11. The Validation of question 7 to test SO: 6.1

You
Is this question valid to ask about SO:6.3?
Q8. Explain the two methods to use CSS cascade style sheet in HTML file .

Question Checker
The question you've presented for SO:6.3 ("Explain the two methods to use CSS cascade style sheet in HTML file") uses the verb "explain," which aligns with Bloom's taxonomy level of "Understanding." Based on the documents, SO:6.3 focuses on supporting the management of Information Systems and requires verbs related to "Understanding" such as "classify," "describe," "discuss," "explain," "identify," "locate," "recognize," "report," "select," and "translate."

Your question's use of "explain" fits well with the verbs associated with SO:6.3. It asks students to discuss the methods of integrating CSS in HTML, which can relate to managing technical aspects of information systems through understanding different integration techniques.

Feedback:

- Alignment:** The verb "explain" aligns with the "Understanding" category necessary for SO:6.3.
- Clarity:** Your question is clear and directly asks for an explanation of methods, which is suitable for understanding and managing aspects of information systems.

Overall, your question is valid and well-suited for assessing SO:6.3 under the provided educational standards.

Fig. 12. The Validation of the explicit question Q8 to test SO 6.3.

D. To Suggest the Right SO

The instructor is free to ask the Question Checker application to evaluate a question using any method. For example, the instructor could request that the app suggest suitable student outcomes rather than inquire about a specific student outcome.

You
Would you find out the following question asks about which SO?
Q9. Write a complete java script code to display in the browser the following text

Question Checker
The question "Write a complete javascript code to display in the browser the following text" primarily utilizes the verb "write," which according to the mapping document of verbs to Student Outcomes (SOs), aligns with the "Applying" Bloom's Taxonomy level. This verb is associated with several specific student outcomes across various sections. Here are the potential SO alignments based on the provided verb:

- SO 1.2:** An ability to apply principles of computing and other relevant disciplines to identify solutions.
- SO 2.2:** An ability to implement a computer-based system, process, component, or program to meet desired needs.
- SO 3.1-3.3:** Various abilities related to communication skills, writing clarity, and development of appropriate illustrations.
- SO 5.1:** An ability to prepare a work schedule for the assigned task and complete it within the appropriate deadlines.
- SO 6.2:** Support the use of information systems within an Information Systems environment.

Based on the nature of the question, which involves writing and implementing a specific solution (in this case, a javascript code to perform a function), the closest match seems to be **SO 2.2**. This outcome focuses on implementing computer-based systems to meet desired needs, which is consistent with writing code to achieve a specific functionality in a software application.

Fig. 13. The Validation of implicitly question 9 to ask about SO 2.2.

Question 9, "Write a complete JavaScript code to display the following text in the browser," is shown in Fig. 13 along with the app's response. As illustrated in Fig. 13, the app validated the question as targeting SO: 2.2 and provided the reason.

The efficiency of the QC application was demonstrated by asking a question that implied a student outcome (SO). The application was used to validate a question aimed at testing an SO implicitly—not by directly asking the app about a specific SO, but by having it identify the correct SO. Fig. 13 shows the question and the app's response with the correct SO. The summary of the tested SO targets is illustrated in Table III.

IX. QUESTIONNAIRE

A survey was conducted to assess academic teachers' acceptance of using artificial intelligence (AI) applications to guide instructors in creating high-quality questions that meet academic accreditation standards and to correct questions submitted by faculty members. The survey was administered in two stages: the first stage occurred before the application was created, and the second stage took place after the application was developed and its efficiency was tested. WhatsApp was utilized to distribute the survey to faculty members across various Saudi universities. In the first stage, the survey received 45 responses, all of which supported using AI tools to guide question creation aligned with accreditation standards. However, 11% of respondents were opposed to allowing the application to correct their questions. Fig. 14 and 15 illustrate the acceptance percentages from the first stage. In the second stage, the survey received 50 responses.

Usability and Effectiveness: Of the 43 responses, 7% did not accept the application's usability. It is possible that those who rejected it are not accustomed to using electronic applications (see Fig. 16 for the usability acceptance rate).

Assistance Rates: The acceptance rate for the application's assistance in correcting questions to meet academic accreditation requirements was 49% (see Fig. 17 for the acceptance rate). However, the acceptance rate for the application's assistance in enhancing assessment effectiveness based on academic accreditation was 33% (see Fig. 18 for the acceptance rate). It is possible that the 17% of respondents who rejected this feature prefer complete independence in question creation and do not want electronic intervention, except by accreditation committees.

Q1- Do you support using AI tools such as ChatGPT technology to guide instructors in assessment questions and exams to align with Academic Programs Accreditation...
مسألة التقييم والاختبارات للتوائم مع الاعتمادات البرامجية...
45 responses

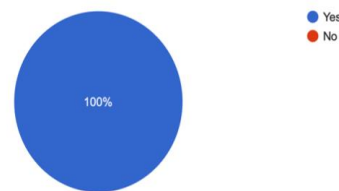


Fig. 14. The Acceptance of using artificial intelligence tools guide in creating question.

Q2- Do you support using AI tools such as ChatGPT technology to correct the created questions by the instructors? هل تود استخدام الذكاء الاصطناعي ك تقنية لتصحيح الأسئلة المقدمة من الأستاذ Chat GPT
45 responses

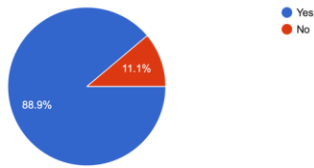


Fig. 15. The Acceptance of using artificial intelligence to correct the questions.

Q1- Is the Question Checker application easy to use? هل التطبيق سهل التعامل
ChatGPT
43 / 50 correct responses

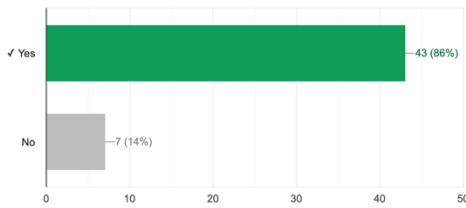


Fig. 16. The Usability agreement percentage of the Application Question Checker.

Q2- Did ChatGPT (Question Checker). supports In assisting conducting tests (error correction, guidance in compliance with the requirements and conditions of accreditations)
49 / 50 correct responses

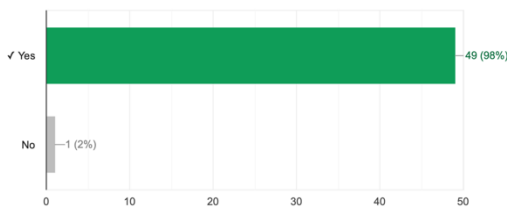


Fig. 17. The Agreement percentage of assisting in correction and guidance of the Application Question Checker QC.

Q3- Based on your practice on ChatGPT(Question Checker), do you support the use of artificial intelligence to help increase the quality of studen... academic accreditations for educational programs?
33 / 50 correct responses

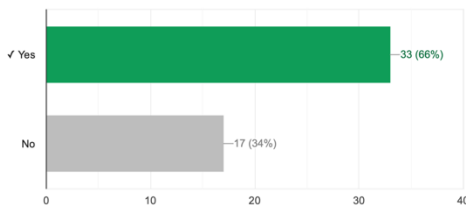


Fig. 18. The Percentage agreement of the application Question Checker QC. in enhancing quality of the as-assessment.

X. DISCUSSION

The study most closely related to this research is referenced in [22]. It investigated the alignment between the two accreditations, NCAAA and ABET, and Bloom's Taxonomy,

with the findings presented in Table I. The process of associating question verbs with the levels of Bloom's Taxonomy and ABET Student Outcomes (SO) was accomplished and is shown in Table II. The previous work [22] primarily focused on aligning educational content with the standards of both the NCAAA (National Commission for Academic Accreditation and Assessment) and ABET (Accreditation Board for Engineering and Technology).

In contrast, the proposed research advances this by introducing generative AI tools, specifically ChatGPT, to enhance the quality of test questions, ensuring they meet the rigorous requirements of both accreditations simultaneously. This study involves testing the efficacy of a custom application, named Question Checker, designed to validate and improve questions in alignment with these accreditation standards.

A key innovation of this research is the mapping of question verbs to Student Learning Outcomes (SLOs), which is critical for ensuring accurate measurement through appropriate questions. The Question Checker (QC) application was developed as a custom ChatGPT tool to verify the compatibility of questions with academic accreditation standards. The application's efficiency in validating questions based on ABET and NCAAA's SOs was rigorously tested. Furthermore, the acceptance of using this technology was assessed, with 100% of participants willing to use the technology for guidance, and 88.9% agreeing to allow the application to correct their questions.

The application successfully provided suggestions for any question aligned with a specific educational outcome. It demonstrated its effectiveness in confirming or rejecting questions submitted to it across all three basic educational outcomes of the applied subject, adhering to alignment conditions with both local and international accreditation standards. The application offered suggestions for all submitted questions, explaining the reasons for acceptance or rejection based on alignment with the quality standards of both local and international accreditation.

Additionally, the program was tested in two scenarios to verify its effectiveness:

- The teacher specifies the Student Outcome (SO), and the application either confirms or rejects it.
- The teacher presents the question without specifying the SO, and the application infers the appropriate SO.

In experiments, the program succeeded in both either accepting or rejecting questions based on a predefined SO and in identifying the appropriate SO for questions presented without a specified outcome.

XI. CONCLUSION AND FUTURE WORK

This study introduces a mechanism for using ChatGPT to assist teachers in generating high-quality questions, thereby saving time and providing an effective means of assessing student learning outcomes. The ChatGPT application was successfully developed and thoroughly tested. This research presents a framework for utilizing generative AI applications to enhance educational assessment tools and promote assessment

equity. Specifically, the ChatGPT application for evaluating questions in IS courses was created and tested. The application's efficiency was demonstrated by its ability to assist in creating appropriate questions, provide steps for crafting questions, validate and correct questions, and suggest the correct Student Outcome (SO) for implicit questions. In future work, this study will be extended by testing the application for generating questions across different courses within the same field. Additionally, a comparison of results across various courses or open programs will be conducted to evaluate the application's effectiveness and adaptability in diverse educational contexts.

The application link is: <https://chatgpt.com/g-g-7iUiGMgOD-question-checker>.

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