An artificial intelligence-based tool for student-generated question

Yeni Anistyasari1*, Ekohariadi1, Muhammad Turhan Yani1, Oce Wiriawan1, Shintami C Hidayati2

1Universitas Negeri Surabaya, Surabaya, Indonesia
2Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia

Abstract. The benefits of student question generation have been extensively established, yet most students do not engage in question-generation activities throughout their formal education and are not used to writing questions. The goal of this project was to create a flexible online learning environment that highlights several types of scaffolding in order to better assist student question production activities in a timely, adaptable, and practically possible manner. The system's underlying architecture and design principles are outlined. The objective of this work is so utilise Chat-GPT that guides student generated questions. The potential of the student-generated question method of instruction is explored, as is an initial examination of students' impressions of the helpfulness of the different built-in support systems. Suggestions on how the study's findings could be used in the classroom and in future research are offered. It has been established that perceived utility plays a significant influence in the dissemination and acceptance of new technology for a wide variety of innovations. Finally, the link between the students' impressions of the utility of the framework in the established system and their cognitive skills regarding the educational potential of student-generated questions was investigated.

1. Introduction

It has been challenging to develop formative and summative evaluations that are suitable for the learning objectives and content of this course since the course serves both an introduction and an informative purpose. This online course has been offered for seven years, and during that time, a variety of methods for evaluating students' knowledge have been implemented. These methods include having students post responses to a discussion board pertaining to each topic, selecting and analyzing an engineering-related article, participating in an instructor-designed multiple-choice examination, and keeping a journal focusing on content-related issues [1]. Because of the writing techniques, the teachers of this expanding and high-enrollment course, which has an average of 120 students for each autumn and spring session, were left with the impossible task of grading the student's work. Exams using multiple choice questions that were designed by the instructor-led to an excessive amount of rote memorizing of specific information, many of which were not necessarily of interest to the students and were not even fundamental to a knowledge of the profession. The goal of the instructional
team was to construct formative and summative assessments for the course that would interest students in the material being taught, as well as assessments that were suitable for the learning goals and could be easily evaluated by the teachers.

Basically, it is not a novel notion that students need to participate in learning activities that encourage active engagement with the content of the classes they take. It is a key premise that is held by educational researchers. Even though there is widespread agreement that this method should be used in education, putting the techniques into practice may be challenging. Exams with multiple-choice questions are a typical method of evaluating students' knowledge and skills. The simplicity of use and objectivity of grading, both of which are particularly crucial for classes with a large number of students enrolled, are the key reasons many instructors choose this technique. The assessment format provides a number of other benefits as well [2-3].

Activities in the classroom that encourage students to do independent research on a topic need more time and energy from teachers, which is not always possible. Significant obstacles may be found in educational settings that include a large number of students from a varied range of backgrounds with instruction delivered remotely. Not only does an environment like this call for interesting activities to seize and keep hold of student motivation, which is a fundamental factor in determining student retention, but it also calls for a significant amount of assistance and feedback from the teacher [4].

Students have numerous chances to answer questions within the framework of official educational systems, but they seldom have the opportunity to ask questions themselves. In the scientific field, the ability to ask questions and seek answers is a particularly valuable talent that teachers want to instil in their pupils. However, owing to the time constraints placed on teachers, students seldom participate in this kind of activity [5]. Many theorists agree that for learning to occur, students must actively apply, practice, and struggle with the material in meaningful, situated, and collaborative ways; however, these theoretical frameworks necessitate complex learning experiences (coupled with necessary learner scaffolding) that engage both cognitive and affective domains [6].

Assessing student progress in large lecture halls is a major concern for the education sector since it is challenging to find a happy medium between providing experiences that encourage student investigation of a subject and keeping an instructor's workload manageable. This problem arises because evaluating student progress in large lecture halls remains a laborious endeavor. One possible strategy for striking this balance is to use questions that were produced by the students themselves as a formative evaluation [7].

Because students lack experience and have problems in connection to the invention of questions, it is important to give special thought to the design of various methods to aid students throughout the process of question production. We built a web-based question-generating learning system for students that places an emphasis on adaptability and a wide range of scaffolding methods. Using computer network technology for student question production in a large class environment was considered because of the possibility that it would be more efficient, effective, user-friendly, safe, and manageable.

The conceptual framework that served as the basis for the development of the system and its explanation is offered. The promise of the student-generated-question approach to learning is discussed, as well as preliminary research into students' perspectives on the utility of the various built-in support systems. Student perceptions of the possibilities of a learning strategy based on student-generated questions are the subject of this research. In conclusion, the study's results are provided, along with some suggested applications to future research and classroom instruction.
2. Method

All levels of schooling may benefit from the system's flexibility to support a broad variety of student question-generation learning activities. Questions may be presented in a variety of forms, including as true/false, matching, multiple choice, fill-in-the-blank, short-answer, and essay. Students must fill out all required fields with precision for their submissions to be accepted. In the context of creating multiple-choice questions, contributors must provide a question stem, four possible answers, an answer key, and any relevant annotations.

Since text-only test formats may not accurately depict testing situations, it is also important to recognize the value of multimedia capacity. Language, music, art, science, mathematics, and so on all place a premium on the ability to identify and differentiate between visual and auditory stimuli, making the incorporation of multimedia features vital and advantageous. In order to convey their intended testing situations in a clear and comprehensive way, question-writers might benefit greatly from the usage of computer technology that supports multimedia applications. Authors of questions have the option of incorporating various types of multimedia into the system to enrich the text and act as a stimulus for testing. This might include photos, animation, sound, and video.

3. Results and Discussion

There are several ways in which scaffolding might help improve a classroom setting. Scaffolds come in all shapes and sizes and provide support on many different fronts. Cognitive scaffolding for learning has been conceptualized from a variety of angles, and many dimensions and categories have been constructed. Our system now makes use of the supplied conceptual framework. One reason this framework was chosen is that it is widely used in online systems for group cognitive modeling and problem-solving.

To improve interaction, cooperation, and meaning-negotiation between writers of questions and their peers, who serve as assessors, a distinct sub-system called "question assessing and reasoning" was built as part of the "reflective social discourse" scaffolding [8]. This was done in order to facilitate the scaffolding's functionality. The question evaluating and reasoning sub-system was developed so that engaging parties may engage in back-and-forth electronic communication on the suitability of the item being investigated as part of the examination process.

In the beginning, a set of criteria that is connected with various categories of questions is presented in an online evaluation form. This is done to facilitate dialogue that is more targeted, objective, and productive. For example, in the case of multiple-choice question evaluation, typical errors (such as unclear question stems, overly complicated question stems, excessively verbose options, multiple correct answers, elusive phrasing, implausible distractors, and so on) as determined by professionals in the field of test development are listed in a scroll-down menu. In addition to providing feedback based on these pre-determined criteria, assessors may also provide feedback in the form of comprehensive ideas for the topic that was examined by writing those suggestions down on a feedback form.
How to join tables in SQL query

In SQL, you can join tables together using the `JOIN` clause. There are several types of joins, including INNER JOIN, LEFT JOIN (or LEFT OUTER JOIN), RIGHT JOIN (or RIGHT OUTER JOIN), and FULL JOIN (or FULL OUTER JOIN). The type of join you choose depends on the specific requirements of your query.

Here's a basic example of joining two tables using an INNER JOIN:

```
SELECT column1, column2
FROM table1
INNER JOIN table2 ON table1.columnX = table2.columnY;
```

In this example:

- `SELECT` specifies the columns you want to retrieve from the tables.
- `table1` and `table2` are the names of the tables you want to join.
- `INNER JOIN` is used to specify the type of join. You can replace it with `LEFT JOIN`, `RIGHT JOIN`, or `FULL JOIN` depending on your needs.
- `ON` is used to define the condition for the join. In this case, it's matching rows where `table1.columnX` equals `table2.columnY`. You can replace this condition with any appropriate criteria for your specific situation.

Fig. 1. Student-generated question utilizing Chat-GPT.

After obtaining the responses of the assessors, the writers of the questions have the opportunity to reply to the assessors' remarks by incorporating their ideas into the revision of the question that was reviewed. If the writers, on the other hand, do not agree with the remarks in their entirety, they may still defend their queries by providing an explanation of their reasons to the evaluators, who will then be able to provide further feedback. In a nutshell, the reasoning phase consists of a continual constructive discussion between writers and assessors, with the goal of optimizing the efficiency of the networked learning community as a support mechanism for the person who authored the question [9].

To ensure that group debate proceeds as smoothly as possible, a mechanism was also implemented to alert participants when they get new messages. This action was taken so that the procedure could be as effective as possible. To be more explicit, when authors and raters get responses to questions or ratings, a blinking red indication displays on their screens. By clicking the icon and the "proceed" button in the window, students are sent directly to the message in question, where they may take the necessary action (for example, change the question, engage in comprehensive explanation, etc.). This happens when the offending mail is sent directly to the student. When enabled, users get notifications whenever they have new messages and may respond right away [10]. Artificial Intelligence shows the imitation by automated systems, especially computers, in the functions of human intellectual ability [11-14]. With the use of in-question show/hide controls, a "learner portfolio" stores all of the work produced throughout the process and makes it easy to retrieve the necessary pieces when needed. This is done in order to achieve "process display" [4]. Different versions of questions were generated (indicated by the number of dots on a simulated dice), and authors and assessors interacted with each other and the questions they examined (for example,
assessors rated, commented on, and suggested improvements to the questions; the question generator provided elaborate explanations) [3].

In the observational learning areas designated for "process models," students have access to sample questions to reference as they craft their own. The system allows instructors to choose which student-made example questions will be available for other students to see by clicking an "add to observe" button. If the system has a rigid framework, with little room for customization by teachers, it will be less effective and run counter to the principle of scaffolding. This is due to the fact that several factors including the teacher, the student, the content, the educational event, and so on can influence the kind of assistance that is needed in any given circumstance. Having a modifiable choice that opens the door to more possibilities is essential. Thus, the system's design prioritizes features and support mechanisms that can be dynamically adjusted to suit the educational goals and lesson plans of individual teachers in different settings (a form of assistance known as adaptive support). The following dimensions are all modifiable by teachers inside the system [10].

The research that has been done on the development of tests has made it abundantly clear that various kinds of questions each have their own set of advantages and disadvantages. In addition, various types of questions elicit distinct patterns of cognitive processing and behavioral reactions from respondents. Within the framework of the system that has been established, teachers have the ability to indicate either in advance or on the fly the particular category or categories of questions that they want their students to concentrate on formulating during a particular class period [2].

The many subsystems and functionalities that may be accessed by pupils. According to what has been mentioned, several subsystems and functions have been put into place to assist the learning activities of students via the use of question creation. Nevertheless, during a particular session of training, the teacher could decide that they only wish to activate a certain subset of the available functions or subsystems.

For instance, a teacher can decide to disable the question assessing and reasoning sub-system if there is not enough time available for such activities during the class, or they might choose to limit the observation function until after students have acquired some expertise in question generating. These are just two examples of how an educator might choose to modify the functionality of the system. Because the display may be customized to show just the necessary sub-systems and functionalities, teachers are able to direct their students' attention to certain assignments without having to fear that their pupils would get overwhelmed or excessively distracted by the display's other features and capabilities [5].

The advantages of dual coding are lost on the classroom instructor who prepares courses for "kinesthetic learners" because she buys into the learning style fallacy. Giving pupils sweets as a reward system and appealing to extrinsic motivators is a common practice, but teachers who do so may be undermining the students' intrinsic incentive to study, which is crucial for retention. A teacher who ignores the evident advantages of direct teaching and scaffolding in favor of unguided learning and random exploration is not only wasting class time, but is also likely contributing to the instillation of misunderstandings and dissatisfaction. Every time a fallacy is employed in a classroom, even if it doesn't have any obvious negative consequences, it prevents a more productive tactic from being used. Some of the findings concerning the principles mentioned here may be influenced by neuroscience, which may in turn shape our beliefs about learning and, by extension, educational methods. However, it is hard to see K-12 or higher education teachers making effective use of neuroscience research if they do not employ the decade's worth of data available in cognitive science to inform their existing practices. We contend that educators may benefit from a deeper knowledge of the complex insights that neuroscience can give if they have a firmer grasp of the principles stated in the learning sciences, especially the well-established and fundamental ones we emphasize here.
4. Conclusion

In conclusion, the framework that was discussed that was used to guide the construction of the configurable scaffolded online learning environment for activities based on student-generated questions was detailed. After being subjected to a number of preliminary assessments, the system that was built has been implemented in a broad range of educational settings (for example, English and science classes in elementary schools; biology classes in secondary schools; college-level physics laboratories; a variety of graduate-level courses; and so on). The feedback from the instructors confirmed that the system is flexible and sensitive to the needs of the instructional process, both of which are essential for the system's long-term viability and scalability. In order to have a better understanding of how valuable the many built-in elements are for the facilitation of student-generated activities, an investigation into how helpful students find the different support mechanisms was conceived.

The link between the students' impressions of the utility of the framework in the established system and their cognitive skills regarding the educational potential of student-generated questions was investigated. This was done with the intention of finding out how the two concepts are related. For further works, the participants and the instructional setting of the study are presented, followed by a description of the research design, techniques, and instruments, and finally, a discussion of the findings is offered.

Acknowledgment

Thanks to DAPT-EQUITY Program, Lembaga Pengelola Dana Pendidikan (LPDP), Ministry of Finance, Indonesia for supporting this publication.

References

2. S. F. Kusuma, D. O. Siahaan, and C. Faticah, Knowledge-Based Syst. 249 (2022)
3. J. Ribosa, D. Duran Educ. 37(2022)
7. S. Juan, Nurse Educ. 97(2021)