Region - Educational Research and Reviews, 2024, Volume6, Issue9
DOI: 10.32629/rerr.v6i9.2925
ISSN Online: 2661-4634
ISSN Print: 2661-4626

# Automatic question generation in education: challenges and opportunities

**Xiangyuan ZHANG**

College of Education, Zhejiang Normal University, Jinhua 321004, China

**Abstract:** Automatic question generation (AQG), as one of the important applications of artificial intelligence generated content (AIGC), can automatically generate diversified teaching questions to meet students' individualized learning needs, reduce teachers' burden of lesson preparation, and improve teaching efficiency, which has gradually shown a broad application prospect in the field of education. However, this technology still faces challenges in practical application, such as technical adaptability, question quality evaluation, application promotion, and ethical and legal issues. In the future, with the continuous iteration of technology and cross-domain integration, question generation technology is expected to further promote the change of teaching mode and the intelligent, personalized and fair development of education.

**Key words:** automatic question generation; AI-generated content; pre-trained models; personalized learning

## 1 Introduction

Compared with other intelligent educational technologies (e.g., intelligent recommendation, learning analytics, etc.), the question generation technology is not limited to optimizing the existing teaching process, but can also be deeply involved in the automated generation of teaching content, which provides a new path for personalized learning, teaching evaluation and educational equity [1]. In this paper, we will systematically analyze the application status quo, challenges and future development opportunities of question generation technology, explore the future development trend of this technology in education, and discuss how to use this technology to generate high-quality, educationally valuable questions and effectively integrate it into different teaching scenarios, with the hope of providing useful reference for further research and practice in this field, and promoting the transformation of the education model into a more flexible, efficient and personalized one.

## 2 Technology application status in education field

In the field of education, the first application of question generation technology is to automatically generate all kinds of high-quality exercises to enrich teaching resources, enhance the breadth and depth of teaching content, and reduce the burden of teachers' preparation and repetitive labor. Secondly, the technology can also generate customized questions according to students' individual situation, helping them to solve their weak points in learning, and promoting personalized learning and ability enhancement. In addition, question generation technology can also be used for learning assessment, which can generate a variety of questions simulating the style of the real exam through the learning platform to help teachers fully understand the knowledge mastery and ability level of students and quickly generate the corresponding

feedback and assessment reports, so that teachers can adjust teaching strategies and improve teaching effectiveness. Overall, the application prospect of question generation technology in the field of education is very promising. With the continuous progress of technology and continuous expansion of application scenarios, the technology is expected to play a greater role in the field of education.

## 3 Challenges

3.1 Technical challenges

The quality of generated questions is directly related to their usefulness in education, but the current mechanism for guaranteeing and evaluating the quality of questions is not yet perfect. In addition to being accurate, relevant and appropriately difficult, a high-quality test question should be assessed for its pedagogical value from a pedagogical point of view to ensure that it contributes effectively to student learning. However, commonly used automated assessment metrics in existing studies, such as BLEU, METEOR, and ROUGE-L, evaluate text fluency mainly by mechanically calculating the degree of literal similarity between the generated sequence and the reference sequence. Although these metrics help to assess text quality to a certain extent, they cannot fully reflect the actual educational value of question generation, and ultimately still rely mainly on the subjective judgment of human experts [2]. Teachers need to invest a lot of time in evaluating, screening and modifying model-generated questions in order to ensure that they meet the teaching objectives and students' needs, which to a certain extent offsets the efficiency gains brought by technology. Therefore, how to establish uniform standards and automated rubrics to systematically assess the quality of generated questions is an issue that needs to be thoroughly researched and solved.

3.2 Application-level challenges

The application of question generation technology in personalized learning requires a large amount of student data for support in order to generate customized questions based on students' individual situations. However, in practice, the collection and use of students' learning data face multiple limitations, and most of the current question generation systems still rely mainly on students' static data (such as test scores, classroom performance) for problem recommendation, which lack a real-time monitoring and feedback mechanism for students' dynamic learning behaviors, making it difficult to truly achieve highly personalized learning support. In order to make the problem generation technology effective in all kinds of teaching environments, from classroom teaching to distance learning, from basic education to higher education, it is necessary to adjust and optimize the teacher training, curriculum design, teaching evaluation, hardware and software support and so on. To this end, education policy makers, educators and technology developers need to work closely together to explore effective integration paths and avoid the formation of "technology silos" [3].

## 4 Opportunities and prospects

4.1 Direction of technological innovation

In response to the imperfections of the current automated evaluation system for question generation results, another important direction for future technological innovation is to construct a more scientific and systematic automated evaluation mechanism, which seeks to replace the evaluation process of human teachers. Not only should the fluency and accuracy of the questions be evaluated, but it should also be combined with deep semantic understanding and learning analytics to comprehensively evaluate the educational value of the questions, the relevance of the knowledge points, the degree of difficulty, and the degree of learner matching of the questions and other multi-dimensional indicators. In this way, teachers will be able to adopt and trust the generated questions more easily, dramatically increasing the value of question generation technology in the field of education.

4.2 Changes in teaching models

Under the framework of the traditional education system, students are often limited by uniform teaching schedules and standardized teaching materials, lacking personalized learning experiences. By automatically generating high-quality educational questions, students are exposed to more personalized and interactive learning resources, and are able to develop critical thinking and self-directed learning skills through active thinking and exploration in the learning process. Teachers can also free themselves from tedious teaching preparation work, saving a lot of time and energy to focus on individual differences of students and provide more targeted learning feedback and guidance. In the future, with the further maturation and popularization of the question generation technology, its potential in emerging teaching models such as personalized learning, cooperative learning, independent learning will be further explored, promoting the teaching mode to achieve a profound transformation from "teacher-centered" to "student-centered".

## 5 Conclusion

Throughout the text, the question generation technology is a rising star in the field of intelligent education, which has shown obvious advantages in enhancing teaching efficiency, supporting personalized learning and optimizing the education evaluation system. However, the successful implementation of this technology still needs to overcome a series of challenges. With the continuous progress and cross-field integration of artificial intelligence, big data, cloud computing and other technologies in the future, question generation technology is expected to play a more critical role in future teaching practice, promoting the deep transformation of educational intelligence and digitalization, and facilitating the realization of the "learning-centered" teaching concept, which will ultimately help realize the vision of a more flexible, efficient and personalized education.

## Conflicts of interest

The author declares no conflicts of interest regarding the publication of this paper.

## References

[1] Wang L. 2023. An analysis of the application of artificial intelligence generated content technology in educational examination. *China Exam*, 8:19-27. DOI:10.19360/j.cnki.11-3303/g4.2023.08.003.

[2] Wu YF, Zhang YS. 2021. A review of research on problem generation. *Journal of Chinese Information*, 35(07):1-9.

[3] Zhao Y, He JW, Zhu SC, et al. 2024. Status quo and challenges of large language model security. *Computer Science*, 51(01): 68-71.