

Research on the Innovation Thinking Cultivation Mechanism Based on AIGC From the Perspective of Academic Competitions

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With the quick development in AIGC field, it has shown a great prospect in education, especially in Academic Competitions (AC). AC plays an important role in cultivating Innovation Thinking People (ITP). It can stimulate their innovation thinking and develop their comprehensive capabilities. In our current society, the traditional tutoring methods for AC have exposed some inherent shortcomings, which include that the personalized demands can't be satisfied, the educational resources are hard to integrated, etc. The main point of the article is to investigate the innovation thinking cultivation mechanism, analyzing the deep reasons why AIGC can help enhance the abilities of the contestants, focusing on developing personalized dynamic question banks, emulating the real combat environments, and making customized learning plans. Through the combination of theory and practice, we have built an Input-Enhance-Output (IEO) model for cultivating the innovative thinking, where AIGC can help. Using Chi-square Test of Independence, we proved the strong correlation between the application of AIGC and cultivation of ITP. This research not only contributes the insights on rebuilding the AC tutoring model, but also offers perspectives for developing education technology in future.

Keywords: AIGC educational technology, academic competitions, elite talent cultivation, innovative thinking, personalized learning, input-processing-output model

Introduction

Since AIGC came into the world, it has been experiencing a high-speed iterative development. Up to now, it has behaved better than humans in many fields, exerting a profound influence on the human society. AIGC is extending to many fields, some state-of-the-art models like Sora2, released by OpenAI, can already generate the vivid video that human can hardly detect by their eyes. Classic LLM model like ChatGPT has also evolved to the fifth generation. Generally, AIGC is always showing its great potential, and it can generate

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beautiful words, pictures and videos beyond human's imagination. Leveraging its capability, perhaps we can change the imbalance of education resources in China, and cultivate more Innovation Thinking People (ITP) to our society.

In Academic Competition (AC) field, ACs are always daunting due to the complex questions and knowledge they test. Some of the questions are hard to explain just using the spoken language, which shows a high demand for the coach's verbal expression skills. Experienced coach can use his good communication ability and outstanding drawing skills to help his students to understand the question. But the fact we need to recognize is that there are few premium coaches in society, and most of them cannot finish the aforementioned tasks well. This difference is particularly enlarged between the developed areas and remote areas. With the powerful generation capabilities, AIGC can help with those problems, and perhaps in the future, there are only students who are self-discipline and always willing to learn, who may finally become an ITP, and the lazy students who don't like studying. Economic and environmental factors will no longer be the main obstacles in hindering ITP cultivation.

Design of the AIGC-Based Talent Cultivation Model for Academic Competitions

In this part, we'll introduce our Input-Enhance-Output (IEO) model. First, in the input stage, we can input the basic knowledge of AC and its classic questions with solutions into AIGC. The specific implementation method is to build a knowledge base and connect AIGC to this knowledge base.

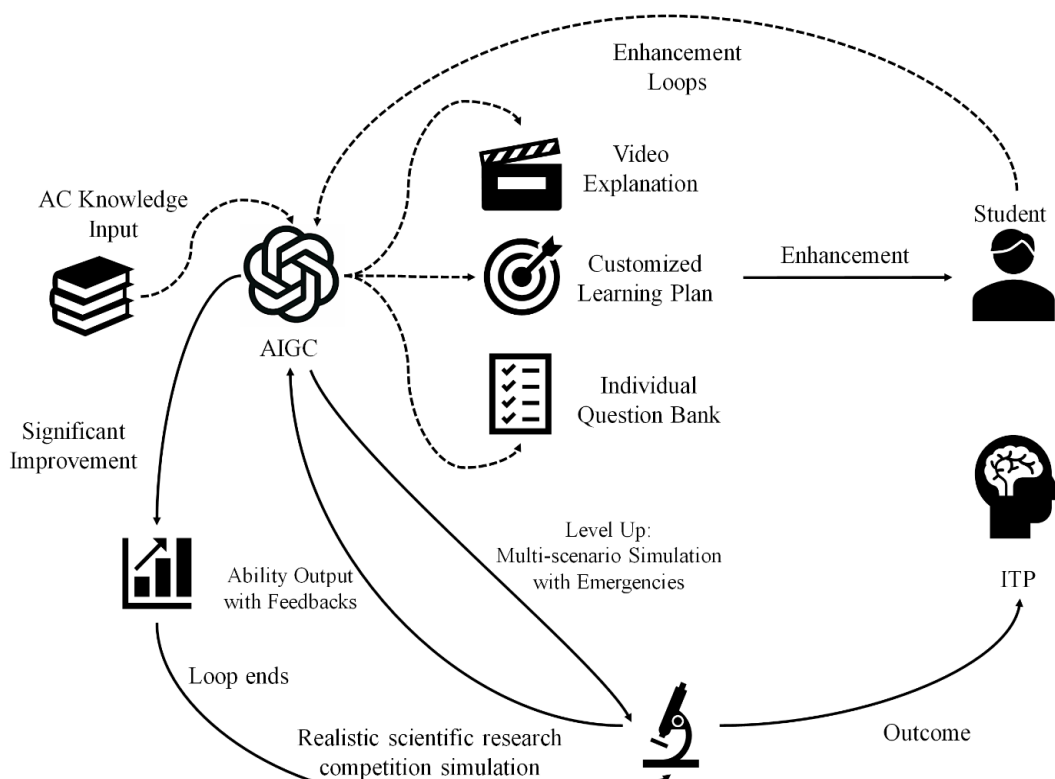


Figure 1. The entire process of cultivating ITP using the AIGC-Based Talent Cultivation Model.

Next is the enhancement stage, whose main target is to enhance the students. After absorbing the knowledge of AC, AIGC can generate the content closer to the real situation. The video generation technique can help

coaches easily impart the obscure knowledge to students, making students have a concrete visual understanding. AIGC can also receive students' feedback like the question they asked, the outcome of their homework, etc. The Q&A interaction is real-time and AIGC can utilize past data to create an individual question banks and customized learning plans, that students can use it to carry out secondary reinforcement, enhance their capabilities.

Finally, the output stage, which is oriented by students after they experienced the reinforcement training. Combined with the virtual reality (VR) and the augmented reality (AR), AIGC can generate highly realistic scenes to simulate the real AC. Different types of emergencies can also be added into scenes, preparing students to be ready for all kinds of unexpected situations. In this stage, students will output the ability they got from the previous stage, adjusting their thinking model when facing the various situations that AIGC made. Their training data will be used as the new input for the next epoch of training. At this point, the IEO has formed a closed loop. The whole process of the AIGC-Based Talent Cultivation Model is shown in Figure 1.

Statistical Questionnaire Survey and Data Analysis Verification

We conducted a questionnaire, whose target is the university students in Shanghai. We distributed electronic surveys and received 1,076 valid responses. The content of the questionnaire is shown in Table 1, and the answer status is shown in Table 2.

Table 1

AIGC Usage and Survey Feedback

Question number	Question content	Options
1	Have you used AIGC technology?	A. Yes B. No
2	Do you use AIGC without thinking, or do you regard it as a tool for training your thinking ability, using it without relying on it?	A. Yes B. No
3	Have you ever published academic papers or participated in any innovation competition and won awards?	A. Yes B. No

Table 2

Statistical Results of AIGC Usage Survey Feedback

Response Types	Q1	Q2	Q3	Sample size
A	Yes	Yes	Yes	435
B	Yes	Yes	No	187
C	Yes	No	Yes	38
D	Yes	No	No	59
E	No	No	Yes	32
F	No	No	No	325

What we want to explore is whether a student who uses the AIGC properly can get more awards and achievement in academics. The Chi-square Test is a statistical method designed for the analysis of categorical data, which assesses the discrepancy between observed frequencies of outcomes and the expected frequencies derived from a specified hypothesis. The core logic of the Chi-square Test is to compare the difference between the observed frequency (O) and the expected frequency (E).

If the difference is small, that means the collected data is consistent with the hypothesis that there is no connection between the two variables. If the difference is large enough that exceeds the threshold value, then we will reject the null hypothesis and turn to believe there is an association between the two variables. What we use to measure the difference is the Chi-square value χ^2 . We show the method to calculate χ^2 in Formula 1.

Formula 1. Formula for calculating the Chi-square value:

$$\chi^2 = \sum \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

Where O_{ij} denotes the observed frequency in the i -th row and j -th column, and E_{ij} represents the expected frequency of the corresponding cell. We excluded 357 data samples from the results of the questionnaires whose answer indicated no use of AIGC. Then we performed the Chi-square Test on the remaining 719 data samples. The Chi-square value was 35.27, which is much larger than the critical value at the significance level (0.01). We can conclude that there is a significant association between the proper use of AIGC and performing well in AC and paper outcomes.

Conclusion and Outlook

In this paper, we analyzed the current development of AIGC and its impact on the education field, and then we proposed our IEO model to exploit the AIGC to its maximum potential in cultivating ITP. The core idea of the model is that, leveraging the high personalization and the customized generation features of AIGC, both coaches and students can utilize it to design the exclusive learning plans. Additionally, AIGC will receive their feedback in real-time and provide them with the solutions according to the feedback. Based on video generation function of AIGC, hard concepts and issues can be easier taught to students, and students' in-depth understanding will also be further enhanced. In our design, we divide the model into three steps: Input-Enhance-Outcome.

The mission of the first stage is to input the basic knowledge of AC into AIGC. After learning the background knowledge, AIGC can perform better and make fewer mistakes. In the enhancement stage, students and AIGC will conduct loops together, that AIGC generates customized study contents and tests while students give feedback to AIGC to make its generation more targeted. Finally, in the output stage, students will conduct simulation training of AC with various emergencies, and they will output their outcome of training. Experiencing the iterative simulation drills, the quality of students' output will be improved, and finally they will develop into ITP. We used the Chi-square Test to prove that AIGC indeed helps students perform well in the AC and the academic research. Generally, AIGC has the potential to solve the problem of uneven distribution of educational resources. We do hope our IEO model can be used when designing the intelligent education product.

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