

# Application and practice of intelligent tutoring system based on critical thinking in psychological experiment design

Xi Xia Jiang<sup>1</sup>

<sup>1</sup>Central China Normal University, China, [269666419@qq.com](mailto:269666419@qq.com)

## INTRODUCTION

With the release of National Education Reform and Development of Long-term Planning Programs, how to train college students' critical thinking has become a hot topic in this era. Operable critical thinking training teaching mode is the crux of the problem, so the construction of operational critical thinking training teaching mode is imminent.

## BACKGROUND

The Education Informatization 2.0 Action Plan issued by the Ministry of Education emphasizes the importance of taking artificial intelligence and other technologies as the basis, we will promote reform of educational models and ecological reconstruction. Intelligent tutoring systems use artificial intelligence technology, let the computer play expert that imparts knowledge and provides learning guidance to learners with different characteristics. Auto-tutor is an intelligent tutoring system based on natural language to simulate the teaching of human teachers. Auto tutor has formed a large family, of which Operation Aries and Auto mentor, based a three-person conversation can be used to train critical thinking skills, and students who use this learning mode can get better learning benefits.

Critical thinking intervention is applied to the specific domain to meet the practicability and operability requirements emphasized in critical thinking training. However, the Auto Tutor based on intervention of critical thinking has not been seen in the Chinese context. Therefore, this study would base on perspective of cultivating students' critical thinking, the intelligent tutoring system in the field of psychological experiment design is designed to test the effectiveness of Auto Tutor by pretest and post-test experimental design in college students.

## RELEVANT THEORIES

### *Constructivism theory*

Knowledge is acquired by learners in a certain teaching situation, under the guidance of teachers and with the help of learning partners, with the use of necessary learning resources, through the way of meaning construction. The initiative of learners and collaboration among learners are emphasized.

### *Situational and cognitive learning theory*

Knowledge is situational, learners constantly interact with the learning environment and acquire knowledge and skills through practice. The learning process is a process in which learners participate in the construction of knowledge under a certain situation.

### *Zone of proximal development*

The system supports the personalized guidance and incentive mechanism to improve the learning effect of learners.

By making learners aware of the learning needs and goals to be achieved, various supports and hints can help learners reach the zone of proximal development successfully, then achieves the learning goal.

### *Teaching mode and critical thinking*

At present, some colleges set up the courses of critical thinking cultivation separately, which can train the ability systematically, directly and effectively. Zhao Shu and Zhao Guoqing et al. pointed out that direct and systematic thinking training can provide students with general thinking and thinking methods, while the combination with specific fields can meet the practicability and operability requirements emphasized by thinking training.

Therefore, more and more researchers believe that training should be combined with special field. In the teaching mode combined with special field, teachers mainly adopt the forms of problem solving, debate, discussion, writing and so on to cultivate students' critical thinking. No matter what kind of teaching mode emphasizes: the ability to show in the various activities engaged in, like reading and writing, critical thinking should be developed through the application in life and study, so that students can promote critical thinking while actually applying critical thinking.

## YOUR RESEARCH METHODS AND WORK

### *How to cultivate critical thinking?*

In terms of training mode, this research adopts the way of combining with special fields for training to achieve the practicability of critical thinking training. In terms of the choice of content, Experimental Psychology has been defined as "a very important specialized basic course" or "one of the core specialized basic courses" for nearly a century and a half, and its teaching difficulties mainly come from the design of psychological experiments. There are 12 typical mistakes in the design of psychological experiments. It is expected that through learning and analyzing these typical mistakes, students' critical thinking will be better improved.

### *How to design the intelligent tutoring system?*

In terms of the selection of ITS, this research chooses Auto Tutor, an ITS based on natural language dialogue, as the research platform. Two teaching agents conduct natural language dialogue, and explain 12 typical flaws, positive and negative examples, consequences and improvement measures, so as to realize personalized teaching. In terms of teaching mode, case-based teaching method is chosen to explain how mistakes occur through specific experimental cases, so as to improve the teaching effect.

### *How effective is the ITS of critical thinking?*

The real classroom was selected and the changes of individuals' critical thinking and the differences in the retention and transfer of knowledge related to psychological experiment design before and after the ITS training were investigated by compare the experimental and control group with pretest and post-test experiment design.

In the current study, participants are asked to complete a brief demographics survey, followed by a pretest with a short research story that ask participants to choose whether it has the 12 typical laws. We record the accuracy rate, response time, and reasons for selection. Participants receive ITS training during the real class. Participants then receive a post-training assessment consisting of two parts. One is the recall of the 12 flaws; the other is a new

research story and participants need to determine if there are 12 typical flaws. We also record the accuracy rate, response time, and reasons for selection.

### REAL WORLD APPLICATIONS

The design and results of this study will have several real world applications. First, construct an intelligent tutoring system based on psychological experiment design to cultivate critical thinking, and form an intelligent agent dialogue system based on case teaching method. Second, through empirical research methods, it is proved that the intelligent tutoring system is effective in cultivating critical thinking, and through tests, it is proved that the system is beneficial to students' learning. Thirdly, the application of intelligent tutoring system in classroom teaching in colleges is an attempt of classroom teaching reform in colleges and an important practice of personalized teaching.

### Future Directions

In this research, vicarious learning would be applied to research on improve critical thinking in psychological experiment design in Auto tutor with an on-screen peer agent, and a tutor agent. In future, the participants may interact with the agents to record the data when they are study.

### SUMMARY

This study utilizes artificial intelligence technology and the application of intelligent tutoring system to carry out teaching reform and practice, improve teachers' information technology level and teaching reform ability, which is conducive to professional development and teacher growth.

For students majoring in applied psychology, an intelligent tutoring system of natural language is designed based on specific courses, which can provide personalized guidance to students in a scientific way and effectively improve students' innovation consciousness and learning effect.

The design and application of this intelligent tutoring system can be used for reference by brother colleges and majors.

### ACKNOWLEDGEMENTS

I would also like to thank my very supportive professors and fellow lab members, each of whom has generously volunteered their time and support to help make this research possible.

### REFERENCES

- Craig, S. D., Driscoll, D. M., & Gholson, B. (2004). Constructing Knowledge from Dialog in an Intelligent Tutoring System: Interactive learning, vicarious learning, and pedagogical agents. *Journal of Educational Multimedia and Hypermedia*, 13(2), 163–183.
- Craig, S. D., Gholson, B., Brittingham, J. K., Williams, J. L., & Shubeck, K. T. (2012). Promoting vicarious learning of physics using deep questions with explanations. *Computers and Education*, 58(4), 1042–1048. <https://doi.org/10.1016/j.compedu.2011.11.018>
- Gao Hongli, Long Zhou, Liu Kai, Xu Sheng, Cai Zhiqiang, Hu Xiangen. (2016). Autotutor: Theory, Technology, Application and Expected Influence [J]. *Open Education Research*, 22(02):96-103
- Graesser, A. C., Cai, Z., Baer, W., Olney, A. M., Hu, X., Reed, M., & Greenberg, D. (2016). Reading comprehension lessons in AutoTutor for the Center for the Study of Adult Literacy. In S. Crossley & D. S. McNamara (Eds.), *Adaptive educational technologies for literacy instruction* (pp. 288–293). New York: Routledge.
- Graesser, A. C., Chipman, P., Haynes, B. C., & Olney, A. (2005). AutoTutor: An Intelligent Tutoring System With Mixed-Initiative Dialogue. *IEEE Transactions On Education*, 48(4), 612–618.
- Graesser, A. C., D'Mello, S., Hu, X., Cai, Z., Olney, A., & Morgan, B. (2012). AutoTutor. In P. M. McCarthy & C. Boonthum (Eds.), *Applied natural language processing and content analysis: Identification, investigation and resolution* (pp. 169–187). Hershey, PA: IGI Global. <https://doi.org/10.4018/978-1-60960-741-8>
- Vygotsky, L. S. (1987). Thinking and speech (N. Minick, Trans.). In *The collected works of L. S. Vygotsky* (pp. 39–285). New York: Plenum Press.
- Wu Yajie, Chen Li, & Zhao Hong. (2014). Research on the Teaching Mode of Critical Thinking Training. *Research in Electronic Education*, 35(11), 71–77.

- Zhang Xuemin, Shu Hua, Zhou Aibao, Zhang Yaxu, & Han Zaizhu. (2005). The practice of constructing the curriculum system of "experimental psychology" in colleges and universities. *Higher Science Education*, (03), 59–63.
- Zhao S., Zhao G., Wu Y., & Xu N., (2012). Thinking training: a catalyst for technology to effectively promote learning. *Research in Modern Distance Education*, (04), 28–34



Xiaxia Jiang is doctor student from Central China Normal University (China). Her major is artificial intelligence and intelligent learning. She obtained her master degree at Southwest University (China) and bachelor at Hubei University (China). Now she also works at lecturer in applied psychology of Hubei University of Science and Technology.