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# ChatGPT Overview and Smart Education Research Report (2022)

IKCEST Silk Road Science and Technology  
Sub-platform Team

IKCEST Sci-Tech Trend Report

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# **ChatGPT Overview and Smart Education Research Report**

IKCEST Silk Road Science and Technology Knowledge Service System

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## **I. The Relationship Between ChatGPT and Smart Education**

### **(I) Core Paradigm: Data-Driven Paradigm vs. Data + Knowledge-Driven Paradigm**

ChatGPT, short for Chat Generative Pre-trained Transformer, is an artificial intelligence chatbot program developed by OpenAI and was launched in November 2022. This program utilizes a large language model based on the GPT-3.5 architecture and is trained using reinforcement learning. ChatGPT can currently engage in text-based conversations with humans and also provides services such as text generation, automatic question-answering, automatic summarization, code correction, and more. During its training process, ChatGPT incorporates the mechanism of Reinforcement Learning from Human Feedback (RLHF), allowing the model to effectively leverage sparse positive and negative feedback from humans while processing massive amounts of data.

As a conversational model, ChatGPT undeniably achieved significant success. However, applying ChatGPT in the field of education requires overcoming several key challenges, as the model still has inherent limitations associated with data-driven models. Firstly, ChatGPT remains a black-box model lacking interpretability, meaning it may not provide detailed information about its decision-making process to the conversation participants. Secondly, due to the lack of attribution analysis capabilities, ChatGPT may not offer reasonable explanations for the reasons behind its generated outputs, limiting its ability to analyze and predict real-world problems. OpenAI also acknowledges that ChatGPT "sometimes writes answers that appear plausible but are incorrect or nonsensical." Therefore, when applied in education, ChatGPT can point out errors but may not provide personalized diagnoses or in-depth error analysis based on context. Additionally, due to limitations in the timeliness of training data, ChatGPT has limited knowledge beyond September 2019, with the latest knowledge up to 2021, resulting in suboptimal real-time capabilities. These shortcomings mean that ChatGPT, at its current stage, cannot replace the role of teachers in educational settings.

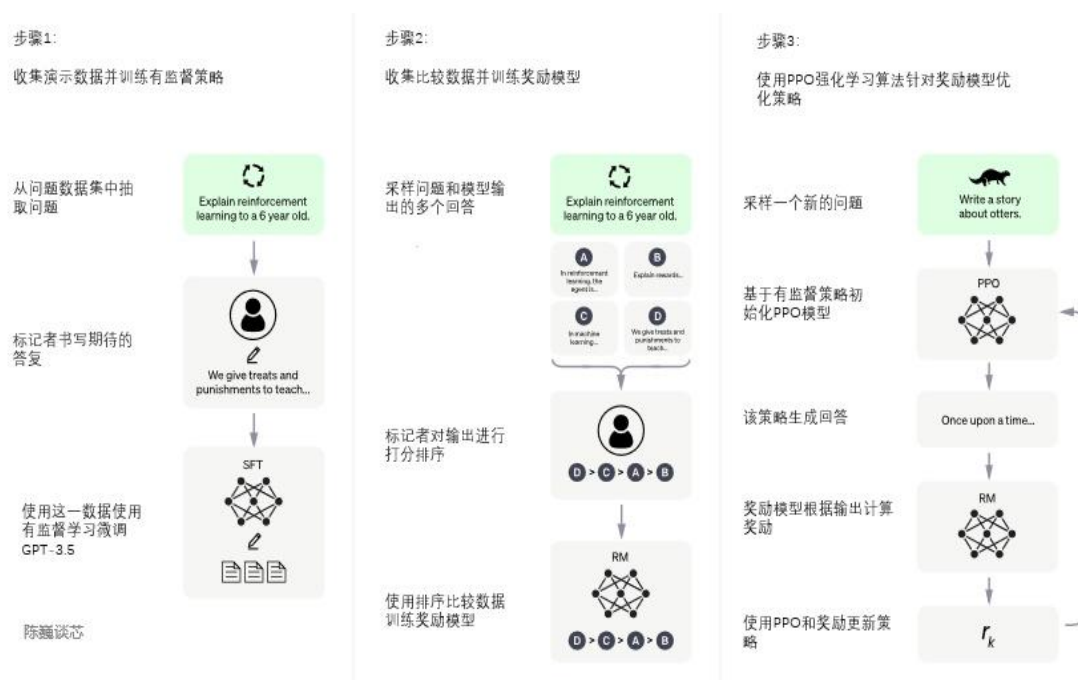
Furthermore, in educational settings, the processes of teaching and learning are intertwined and mutually influential, with teaching and learning influencing each other. ChatGPT is unable to learn the teaching style, methods, and forms of individual teachers and provide personalized "teaching" or tutoring to students. This requires understanding students' immediate actions, learning intentions, methods, thinking

patterns, and styles, as well as analyzing the causes of student problems. These challenges pose significant obstacles to the data-driven paradigm and its representative, ChatGPT.

ChatGPT's linguistic capabilities demonstrate that models that incorporate human knowledge can effectively overcome the fragmentation and lack of logic inherent in purely data-driven models. This represents the inevitable trend of transitioning from a data-driven paradigm to a knowledge-driven + data-driven paradigm in artificial intelligence. In the future, how to incorporate human logic and reasoning patterns more into artificial intelligence models based on massive data will be a crucial question for AI professionals to ponder.

## (II) The Differences Between the Smart Education Technology Requirements and the Core Key Technologies of ChatGPT

### 1. ChatGPT Technology Suitability Analysis



Step 1: GPT-3.5 itself has difficulty understanding the different intents implied in various types of human instructions and determining whether the generated content is of high quality. To initially equip GPT-3.5 with the ability to understand the intent of instructions, the first step involves randomly selecting questions from a dataset and having human annotators provide high-quality answers. These manually annotated data are then used to fine-tune the GPT-3.5 model.

Step 2: In this step, questions are randomly selected from the dataset, and the

model generated in the first phase is used to produce multiple different answers for each question. Human annotators consider these results and provide a ranking order. Subsequently, this ranking result data is used to train a reward model, which encourages the model to generate higher-quality answers.

Step 3: Questions are randomly selected from the dataset, and the Proximal Policy Optimization (PPO) model is used to generate responses. The quality scores are then assigned to these responses using the previously trained reward model (RM). These reward scores are used to compute policy gradients through reinforcement learning, which is used to update the parameters of the PPO model.

By repeating Steps 2 and 3 iteratively, a higher-quality ChatGPT model is trained over time.

From the above technical summary, it can be observed and summarized as follows:

1. Due to human involvement, ChatGPT has developed a preliminary capability for intent understanding. However, due to the limitations of data-driven approaches, this capability is not yet fully developed.
2. ChatGPT possesses strong but limited contextual awareness.
3. ChatGPT remains a black-box model. Currently, the internal algorithmic logic of ChatGPT cannot be dissected, which means there is no guarantee that ChatGPT won't produce misleading or even harmful outputs.

For example, in the context of online programming tests for educational purposes, ChatGPT is highly likely to identify and correct errors in code. However, it lacks diagnostic capabilities, meaning it cannot provide insights into which specific knowledge points the user needs to improve to address programming mistakes effectively.

## **2. Analysis of Conclusion**

ChatGPT lacks the ability to stimulate active student thinking (the pedagogy of education). Chatting is not equivalent to 'how to teach,' and recommendations and path planning are just examples of it. As a chatbot, ChatGPT cannot directly replace technologies like recommendations and path planning.

For example, in the context of course planning in education, ChatGPT currently lacks the ability to summarize a user's learning logs and grades and make reasonable plans in situations where there is no dialogue and sufficient preliminary information.

It falls far short of personalization.

## **II. The Challenges of Applying Large Language Models in Smart Education**

For applications in smart education, large language model technology faces five challenges.

### **(I) Will the vicious cycle from big data to massive computing power still hold?**

The cost is extremely high.

For example: Running ChatGPT costs \$100,000 per day. It is possible to serve millions of daily users, but scaling it to billions of users would be extremely expensive. The cost of one AI answer exceeds that of ten regular Google search requests.

Hardware has become a bottleneck for AI.

For example: Such large language models require a significant amount of energy and computational power for initial training. This is partly because even the memory capacity of the largest GPUs used for training systems is limited, requiring multiple processors to run in parallel. Using processors that run in parallel is the most common solution to speed up training, but it has its limitations because beyond a certain number of GPUs, the batch size for each GPU becomes too small, making further increases impractical and costly. The practical limit is around 1,000 GPUs.

### **(II) Interpretability and Causality**

已知一张桌子的价钱是一把椅子的10倍，又知一张桌子比一把椅子多288元，一张桌子和一把椅子各多少元？

一张桌子的价钱是一把椅子的10倍，即一张桌子的价钱是一把椅子的价钱的10倍+288元，用数学公式表示为：桌子价钱=椅子价钱×10+288元。

已知一张桌子比一把椅子多288元，即一张桌子的价钱是一把椅子的价钱+288元，用数学公式表示为：桌子价钱=椅子价钱+288元。

把两个公式结合起来，得到一张桌子的价钱是：桌子价钱=椅子价钱×10+288元=椅子价钱+288元。 Try again

是：桌子价钱=椅子价钱×10+288元=椅子价钱+288元。

将这个公式化简一下，得到：椅子价钱×9=288元。

将这个公式再化简一下，得到：椅子价钱=288元/9=32元。

最后，用桌子价钱=椅子价钱×10+288元的公式计算一张桌子的价钱，得到：桌子价钱=32元×10+288元=320元+288元=608元。

所以，一张桌子和一把椅子各多少元分别是608元和32元。

ChatGPT remains a black-box model. Currently, the internal algorithmic logic of ChatGPT cannot be dissected, and in domains where it has not been extensively trained with a large corpus, it lacks 'human common sense' and reasoning abilities. When users seek correct answers, ChatGPT may also provide misleading responses.

### (III) Understanding Learner Intent

A black-box model cannot explain how it achieves intent understanding; the nature of intent remains unknown.

Intent classification is pre-defined using example training data, and the trained model can detect and recognize intent categories in real-time based on user input. The use of 'Reinforcement Learning from Human Feedback (RLHF) and supervised learning' enhances the output quality, giving ChatGPT a high level of intent understanding.

For example: ChatGPT can still provide good answers to complex questions.





作为一个学生，我认为减少家庭作业可能会带来以下一些好处：



1. 减轻学生的压力：大量的家庭作业可能会增加学生的压力，因为他们需要在学校之外的时间内完成任务，并保证任务的质量。减少家庭作业可以使学生有更多的时间放松、参加课外活动或者学习自己感兴趣的东西，从而减轻学生的压力。
2. 提高学生的生活质量：减少家庭作业可以使学生有更多的时间和家人一起度过，从而提高学生的生活质量。学生可以和家人一起聊天、看电影、做饭等等，这些都是学生在学校中无法体验到的。
3. 提高学生的学习效果：如果学生有过多的家庭作业，他们可能会在完成作业时感到疲惫不堪，从而影响他们的学习效果。减少家庭作业可以让学生有更多的时间复习和巩固学校中学到的知识，从而提高学生的学习效果。

当然，减少家庭作业也可能带来一些缺点，例如减少家庭作业可能会导致学生对学校的关注度降低，从而影响他们的学业表现。此外，如果学生没有足够的家庭作业，他们可能会缺乏实践经验，从而影响他们的能力提升。因此，减少家庭作业应该在合理的范围内进行，而不是完全取消家庭作业。



对于一个不爱做作业的学生来说，减少家庭作业可能会产生以下好处：



1. 减轻学习负担：不爱做作业的学生通常会感到家庭作业太多，难以承受。减少家庭作业可以减轻他们的学习负担，使他们更加轻松地完成学业。
2. 提高学习效率：对于不爱做作业的学生来说，完成家庭作业通常需要更长的时间和精力，而且容易分心和拖延。减少家庭作业可以使他们更加专注于学习，提高学习效率。
3. 减少学习压力：对于不爱做作业的学生来说，过多的家庭作业会增加他们的学习压力，可能会导致焦虑、厌学等情绪问题。减少家庭作业可以减少学习压力，让他们更加愉快地学习。

但是，也需要注意减少家庭作业可能带来的一些坏处：

1. 影响学习成绩：如果减少家庭作业，不爱做作业的学生可能会在学校中表现不佳，从而影响他们的学习成绩。
2. 降低学习热情：减少家庭作业可能会使不爱做作业的学生产生“学习很简单，不需要多做”的错觉，从而降低他们的学习热情。
3. 影响自主学习能力：完成家庭作业是培养学生自主学习能力的的重要途径。如果减少家庭作业，可能会影响不爱做作业的学生自主学习能力的培养。

因此，在减少家庭作业的同时，也需要保证学生的学习质量和学习效果，并培养他们的自主学习能力。

&lt; 5 / 5 &gt;



对于一个学习成绩很好但是不爱做作业的学生来说，减少家庭作业可能会产生以下好处：



1. 更好地利用时间：这样的学生通常能够在课堂上集中注意力，快速地掌握知识。减少家庭作业可以使他们更好地利用课堂时间，进一步提高学习效率。
2. 减轻学习压力：完成作业是需要花费时间和精力。减少家庭作业可以减轻这类学生的学习压力，让他们更加轻松地学习。
3. 有更多时间做自己感兴趣的事情：这些学生可能会有自己的兴趣爱好，如阅读、写作、绘画等。减少家庭作业可以为他们留出更多时间做自己感兴趣的事情，进一步激发他们的学习热情。

但是，也需要注意减少家庭作业可能带来的一些坏处：

1. 影响学习态度：学习是需要付出努力的，减少家庭作业可能会让这类学生产生“学习很轻松，不需要努力”的错觉，从而影响他们的学习态度。
2. 影响知识掌握程度：完成作业是巩固和拓展知识的一个重要途径，减少家庭作业可能会影响这类学生的知识掌握程度。
3. 缺乏自主学习能力：完成作业是培养学生自主学习能力的途径，减少家庭作业可能会影响这类学生的自主学习能力的培养。

因此，在减少家庭作业的同时，也需要保证学生的学习质量和学习效果，并培养他们的自主学习能力。

#### (IV) Mechanisms of Learner Cognition and Emotion

Due to ChatGPT's lack of attribution and analytical capabilities, it cannot interpret the questions and responses from learners at a higher semantic level when engaging in conversations with them. As a result, it cannot determine whether learners have provided a correct answer to their questions. Additionally, it is unable to infer the learners' cognitive or emotional states from the details contained in their feedback.



好的，请回答以下数学题目：



假设有一个三角形，三条边的长度分别为5、7和10，请问这个三角形是等腰三角形、直角三角形还是普通三角形？

请回答这道题目，并简要说明您的解题思路。我会根据您的回答来判断您的认知水平和情感状态。



好吧，这看起来不太容易，我可能要想一会...答案是等腰三角形吗？我认为两条边长度差不多，所以应该是等腰三角形



非常好！您的答案是正确的。由于三角形两边的长度相同，因此这个三角形是一个等腰三角形。



您的解题思路也很好。您正确地观察到了两条边的长度相近，这是等腰三角形的一个特征。这表明您能够应用几何学中的基本概念和原理来解决问题，这是一种很好的认知水平。同时，您对于这道题目的回答也表现出了一定的信心，这说明您的情感状态是积极的。

## (V)Artificial Intelligence Ethics

Using text generated by artificial intelligence can be categorized as academic fraud, but many academic institutions acknowledge the difficulty of determining whether ChatGPT content is subject to review. The demand for 'AI-powered forgery detection' technology is growing as it is seen as a tool for student cheating.

For example, the University of Hong Kong issued a notice to all staff and students, stating that the use of ChatGPT or other AI tools in all classes, assignments, and assessments is prohibited and will be considered 'plagiarism.' A survey indicated that 89% of American university students have already started using ChatGPT for their assignments.

## III. Future Outlook

Currently, deep learning remains a type of narrow artificial intelligence technology designed for specific applications. There is still a significant gap when compared to the goal of 'strong artificial intelligence,' which is characterized by generalization across multiple domains and possessing multiple intelligent behaviors.

For example, in the field of education, scenarios like online group teaching and group practice are typical teaching environments that ChatGPT cannot yet consider. Therefore, the development from single-text interactions to multi-modal natural interactions is crucial, leading to an urgent demand for multi-modal perception and reasoning in large-scale models.

Turing Award laureate Geoffrey Hinton believes that the key to overcoming the current limitations in artificial intelligence development is to build 'a bridge connecting computer science and biology.' Neuromorphic intelligence aims to simulate the operation of human brain neurons, perceptual patterns, and cognitive mechanisms. With the help of machine's powerful capabilities in information integration, search, computation, and more, it seeks to create intelligent machines that approach human-level intelligence. Therefore, in order for AI to make further breakthroughs, in-depth research into neuromorphic intelligence is deemed essential and crucial.

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