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AI as a Co-Teacher: Enhancing Creative Thinking in Underserved Areas

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Abstract: The rapid irruption of AI is a double-edged sword. On the one hand, it poses a high existential risk to humanity, much higher than climate change. On the other hand, it provides an enormous opportunity to improve wellbeing. To handle this double-edged sword successfully, educators must prepare students for a future where citizens repeatedly interact with artificial agents (AAs). Unlike humans, AAs lack fear of death and social exclusion. They do not have family, attachment, or a sense of belonging. However, they have increasingly better abilities to read our minds. To counteract this negative side of AI, students need to understand the hidden psychology of AAs. They need to learn the core computational algorithms that drive the social behavior of AAs. To tackle this challenge, we have been developing creative coloring activities for elementary school students that teach them core AI algorithms. Contrary to multiple-choice questions, these are activities with millions of correct possible solutions. In addition, it is highly improbable that they will be solved by chance. Moreover, in these activities, students must explain their solutions in writing and pose similar problems to their peers. However, given the high complexity of these creative tasks, teachers need support to assess students' work. Thus, we developed an app to support teachers based on our experiences working with these coloring activities with teachers in underrepresented regions such as Chile and Peru and countries of the Southeast Asia Ministers of Education Organization (SEAMEO). The app helps them assess these rich multi-modal collaborative coloring activities by leveraging the power of large language models (LLMs). We present some key features of the app and discuss how it facilitates rapid and cost-effective implementation of these rich but demanding coloring activities.

Keywords: AI, Teacher, Computational Thinking, Creativity, LLM, Underserved Areas.

1. Introduction

The advent of AI, particularly LLMs, has ushered in a new era of possibilities and challenges for education. The potential benefits of AI are immense, promising to revolutionize learning and teaching. However, the rapid evolution of these technologies also poses significant risks, including existential risks, potential misuse, and new inequalities. To harness the power of AI while mitigating its risks, we must prepare students for this new era (Araya, 2023; Araya, 2021c). Central to this challenge is developing students' ability to interact effectively with AAs. Unlike humans, AAs lack the complexities of human emotion, social connection, and biological constraints. Understanding the fundamental differences between AA and us is essential for developing the skills and knowledge necessary to navigate this new technological landscape. AAs are helping us carry out immediate tasks like driving to work, selecting a movie, or tackling pandemics (Araya et al., 2021). However, little by little, they will take in more information and help us make long-term decisions. This means making increasingly life-critical decisions. Then, they will try to get people to trust them. They will replace our closest friends.

2. Coloring activities to learn Computational Thinking

For this entirely new challenge, we propose a novel educational approach to teaching elementary school students computational thinking and AI literacy through creative coloring activities (Araya, 2021; Araya, 2021b; Araya, Isoda, 2023; Somsaman et al., 2024). By engaging students in tasks that require logical reasoning, spatial thinking, problem-solving, written argumentation, and problem-posing, we aim to foster a deep understanding of how AI

works. Moreover, we encourage peer collaboration to develop the socio-emotional skills necessary for effective human-AAs interactions. For example, the coloring instructions presented in Figure 1 teach logic connectors, quantifiers, and the critical importance of the order of instructions. Are these six instructions genuinely different?

- Choose a color and in each box paint at least 2 balls of that color
- In each box choose a color and paint at least 2 balls of that color
- In each box for at least 2 balls choose a color to paint them
- Choose a color and in at least 2 boxes paint each ball of that color
- In at least 2 boxes choose a color and paint each ball of that color
- In at least 2 boxes for each ball choose a color to paint them

The coloring activities present a unique challenge. Unlike multiple-choice question platforms (Araya & Díaz, 2020), these coloring activities offer billions of potential alternatives with millions of correct solutions. This characteristic makes it highly unlikely for students to guess the correct answer by chance. However, each solution can be precisely categorized as correct or not. Thus, it provides clear feedback. These features make the activities particularly effective for developing logical and spatial reasoning skills.

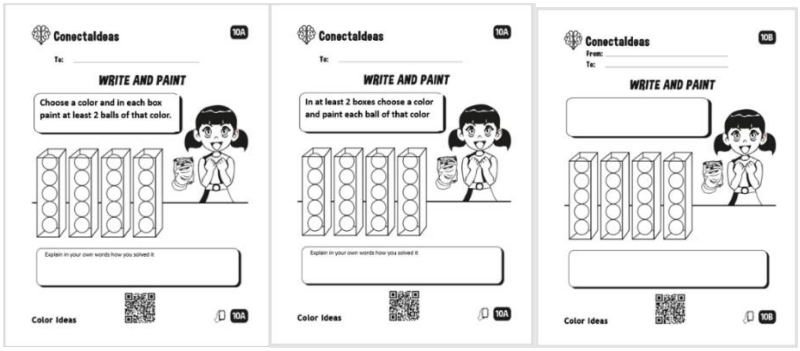

Figure 1. Two coloring problems and a blank page for posing a similar problem to a classmate.

3. On-the-job support for the teacher

These activities develop computational thinking and creative thinking. However, assessing the proposed coloring activities presents a complex challenge. With millions of potential solutions, evaluating student work becomes time-consuming and cognitively demanding. There is no way to provide teachers with all the correct answers for each question. Thus, teachers must meticulously evaluate each response, considering the task's underlying logical and spatial reasoning. Moreover, we propose that students work in pairs and pose new coloring problems to their peers (Araya, 2021). This is a massive transformation of classroom practices. Therefore, as Cuban (2013) highlights, teachers resist significant changes since they typically demand far too much time, energy, and skills. In addition, Labaree (2010) further emphasizes the emotional toll of adopting a child-centered teaching role. The constant need to manage student emotions and navigate unexpected classroom dynamics can be exhausting. This emotional labor and the cognitive demands of facilitating open-ended discussions and projects significantly burden teachers. To support teachers in implementing these new and rich activities, we developed a mobile app leveraging LLMs' power to provide real-time feedback and assessment (Figure 2). Teachers can snap a photo of a student's work. The app recognizes objects, colors, and texts and asks the LLM to assess and provide feedback.

Figure 2. App for the teacher to help assess solutions.

In Tapia & Araya (2024), we tested different prompts. We found that correction performance is excellent using GPT4o with Chain-of-Thought (CoT) (Wei et al. 2024) and Visualization-of-Thought (VoT)) (Wu et al, 2024) and context. This feedback allows teachers to address misconceptions immediately. It offers a promising solution to alleviate teachers´ cognitive load.

4. Conclusion

Transitioning to more open, creative, and inquiry-based teaching practices is complex and challenging. By leveraging the power of LLMs, educators can overcome some of the barriers that have traditionally hindered the adoption of innovative teaching methods. Teachers with real-time LLM-based support can help create more engaging, equitable, and effective learning experiences. The best part is that only teachers need an internet connection. In addition, given the rising prevalence of students´ mental health issues linked to excessive smartphone and social media use (Haidt, 2024), our coloring activities avoid student´s use of digital devices in class. Thus, it helps mitigate the negative impacts on students' well-being, reduces distractions, and frees up teachers' energy. Moreover, it is very cost-effective. The app offers a budget-friendly solution, especially for underserved areas. Our research and development of the AI-powered assessment app have been conducted in collaboration with teachers from underrepresented regions from Chile, Peru, and Southeast Asian countries (Somsaman et al., 2024). In summary, while the shift towards more student-centered, social, creative, and inquiry-based learning is essential for developing 21st-century skills, it significantly burdens teachers. LLMs can serve as valuable tools to support teachers in this endeavor.

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